FISHER VBS7500

MODEL

SERVICE MANUAL

I. INTRODUCTION

In comparison with former models, the mechanism, circuitry, and many other aspects of this model have been significantly improved. The features of this model are listed below.

1. Weight Reduction

Compact, plastic mechanism parts and a plastic frame chassis are used. The plastic chassis for the reel drive section, the aluminium diecast cylinder chassis, the compact power transmission, and a reduction in the number of parts have made this unit much lighter and smaller.

2. Slim Design

The direct-drive motor has been built into the cylinder, the height of the cylinder assembly has been reduced, and an extremely thin direct-drive motor is used to drive the capstan. These and other developments have resulted in reducing the height of the recorder mechanism and giving this unit its slim dimensions.
Furthermore, all operation buttons have been arranged on the front panel in an entirely new design.

3. Improved Operation

Even the eject button, which was manually operated on previous models, has been improved and converted to full electronic soft-touch operation on this unit. And the microcomputer-controlled random access system and quick access mechanism (in which the tape does not have to be wound into the cassette during the FAST FORWARD mode or the REWIND mode) also make this unit very easy to use.

4. Reduced Power Consumption

(1) The degree of integration in the IC circuitry has been increased.
(2) A switching regulator that reduces power loss in the power circuit has been employed.
(3) The head and capstan, driven by direct-drive motors, and the geared reel drive allow a reduction in the power required to drive the mechanism.

A combination of the above improvements and others has drastically reduced power consumption.

5. Improved Picture Quality

A 1H delay line is used in a new noise canceler for the video playback circuit. This noise canceler acts to shield the playback amplifier which processes the fine video head signal, and produces a low-noise, crisp, clear playback image.

6. Newly Developed Microcomputer

A newly developed microcomputer for the timer makes operation very easy and includes a 7-day/1-program timer. In addition, a newly developed microcomputer to control tape drive, electronic eject operation, and other operational improvements have been made.

7. Improved Serviceability

Fewer printed circuit boards are used, and fewer parts are connected to them. The number of screws used to attach printed circuit boards and parts is thereby reduced, and wiring is simplified. These improvements have greatly improved serviceability.

II. VIDEO CIRCUIT

A. PAL COLOUR VIDEO SYSTEM OUTLINE

1. PAL (Phase Alternation by Line) System

The CCIR1 system (U.K.) and the B & G system (West Germany, Holland, etc.) differ according to the transmission bandwidth. The number of scanning lines (625), the number of frames (25), and the interlace system (2:1) are the same for both systems; however, the bandwidth for each channel is 8 MHz in the British system and 7 MHz in the West German system, and the frequency bandwidths of the audio and chrominance subcarriers differ. (Refer to Fig. 2-1-1 for the transmission frequency spectrum.) In order to allow programs to be easily exchanged between the two systems, the chrominance subcarrier frequency, and also the colour signal modulation system, are exactly the same for both systems.

2. PAL System Composite Video Signal

The composite colour video signal E_M in the PAL system is prescribed by the following equation:

$$E_M = E'_Y + E'_U \sin WcT \pm E'_V \cos WcT \ldots (1)$$

Provided that the luminance signal is:

$$E'_Y = 0.299\, E'_R + 0.587\, E'_G + 0.114\, E'_B,$$

and the chrominance signal is:

$$E'_U = 0.493\, (E'_B - E'_Y)$$

$$E'_V = 0.877\, (E'_R - E'_Y)$$

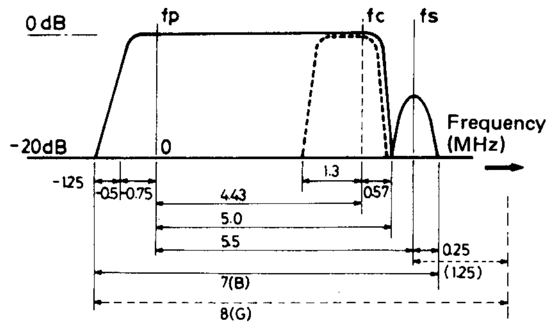
In the above equations, E'_R, E'_G, and E'_B represent gamma-corrected voltages.

The bandwidths for the chrominance signal and the luminance signal are:

Chrominance signal: 1.3 MHz $\leqq$ 3 dB
Luminance signal: 4 MHz > 20 dB

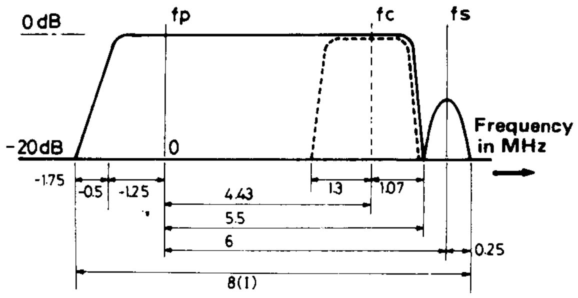
The (R-Y) signal and the (B-Y) signal are transmitted as the chrominance component of the PAL system, and for the (R-Y) signal, modulation is performed by inverting the phase 180° at every adjacent scanning line, particularly to compensate for phase distortions in the transmission path.

(a) West German system



f_P: video main carrier wave
f_C: chrominance subcarrier wave
f_S: audio carrier wave

(b) British system



f_S = 6 MHz - 400 Hz
= 5.9996 MHz

Fig. 2-1-1 PAL system transmission frequency spectrum

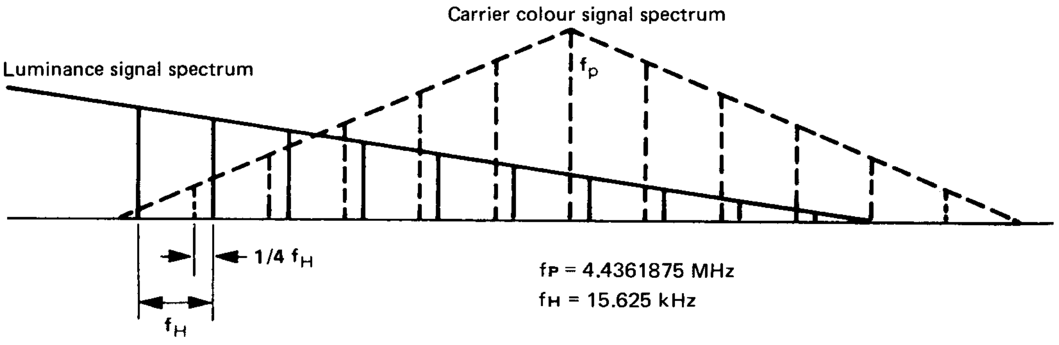
3. PAL System Subcarrier Frequency

The subcarrier frequency (f_P) in the PAL system utilizes a 1/4 line-offset frequency whose relationship to f_H is:

$$f_P = (284 - 1/4)f_H + \frac{f_H}{625} \ldots (2)$$

$$= 4.43361875 \text{ MHz } (f_H = 15.625 \text{ kHz})$$

As shown in Fig. 2-1-2, the spectrum of the carrier colour signal being interleaved with the spectrum of the luminance signal at a distance of only 1/4 f_H.



f_P = 4.4361875 MHz
f_H = 15.625 kHz

Fig. 2-1-2 PAL signal spectrum offset 1/4 line

One scanning line was shown in Fig. 2-1-2; however, the interleaving position for the next scanning line shifts 1/2 f_H because of the phase change of the (R-Y) signal. The addition of $\frac{f_H}{625}$ (25 Hz) to equation (2) in the 625 line system is to make the movement of the subcarrier dot visually less conspicuous. It provides an improvement of 5 dB in the multiplex ratio of the detection limit.

4. Burst Phase

The burst phase corresponds to the phase change of the (R-Y) signal and, as shown in Fig. 2-1-3, is obtained at ±135° from the (B-Y) axis. The colour burst signal is inserted into the video signal in sequence at +135° and -135° from line 9 of field 1 and from line 8 of field 3.

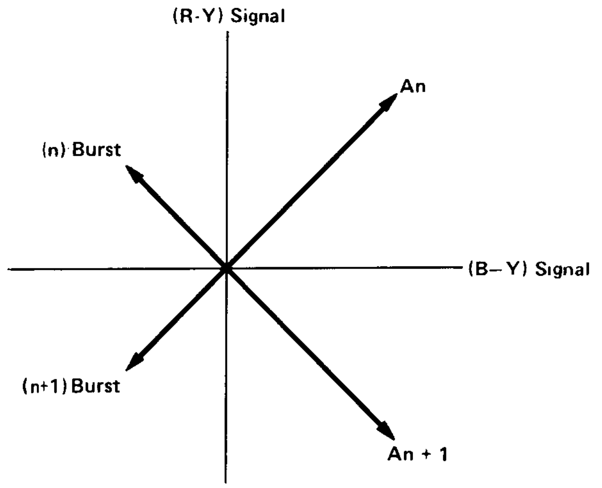


Fig. 2-1-3 **Phase relationship of colour burst signals**

B. BETACORD VIDEO RECORDING SYSTEM

1. Outline

It order to provide a home VCR system in which both the VCR unit itself and the video cassettes used are compact, lightweight, and moderately priced, high-density recording was developed. To make this high-density recording possible, a revolutionary recording system was adopted. The main features of this system are described herein.

a. Recording without a guard band

Recording without a guard band means that the guard band between the video tracks has been removed. When the guard band is removed, there is the problem of cross-talk from the adjacent track; however, the luminance signal places a ±7° azimuth between the two video heads, and, by using the azimuth loss occurring at high frequencies, the crosstalk is eliminated. Because the frequency of the chrominance signal is comparatively low and the azimuth loss is not so large, the crosstalk is eliminated in this revolutionary new colour recording system.

b. Short-wavelength recording

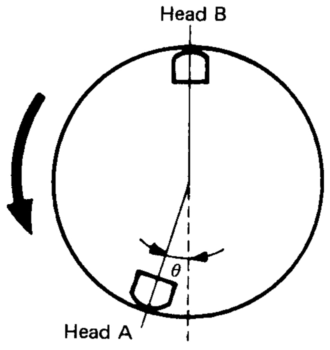
Because the diameter of the head drum is only 74.5 mm, the relative speed of the head to the tape is decreased to 5.83 metres per second, and the maximum recording wavelength (possible recording frequency) is reduced to 1.3 microns. In order to achieve this short-wavelength recording, the width of the video head gap has been reduced to 0.45 microns, and other improvements have been made, such as in the playback sensitivity in the shorter wavelength resulting from the quality of the magnetic recording materials (CrO_2 and $Co\text{-}Fe_2O_3$).

c. Narrow-track recording

In order to decrease the amount of tape used, the track width of the video head has been made narrower so that narrow-track recording with a track width of 32.8 microns can be done. Also, the tape speed has been reduced to 18.73 millimetres per second.

d. H alignment of the video tracks

Because of the necessity of providing this model with a "still frame" function during the PLAY mode, the H alignment between each of the tracks has been provided in order to eliminate the skew distortion during the still frame playback. To accomplish this the installation angle of the video head is regulated as shown in Fig. 2-1-4.
The H alignment is made by installing head A 0.288° later in relation to head B.



θ = 0.288° (equivalent to the gap of 0.5H)

Fig. 2-1-4 Video head positioning for H alignment

e. Luminance comb filter

By passing the playback Y signal through the 1-H comb filter to prevent the mixing of the crosstalk from the adjacent track, the S/N ratio is improved.

2. Colour Recording System

The recording system for the PAL colour signal is a Y/C separation system and is similar to other systems in that the luminance signal is frequency modulated and the chrominance signal is frequency converted to the low frequency range, and then they are both AM recorded. (Refer to Fig. 2-1-5.)

The Y (luminance) signal is frequency modulated by the frequency modulator within a frequency range of 3.8 ~ 5.2 MHz. The C (chrominance) signal is low-frequency converted from 4.43 MHz to $(44 - 1/8)f_H$ on track A and $(44 + 1/8)f_H$ on track B; however, because the recording in this system does not have a guard band, there is a problem during playback from crosstalk disturbance from the recorded signal in the adjacent track. An explanation is given herein for why $(44 - 1/8)f_H$ and $(44 + 1/8)f_H$ were selected as the frequencies for low frequency range conversion for track A and track B, respectively, and also for the method used for elimination of the previously mentioned crosstalk.

a. Low frequency range conversion chrominance signal frequencies

As an example, the playback of track A is as follows: It was previously mentioned that the chrominance frequency that is converted to the low frequency and recorded on track A is $(44 - 1/8)f_H$; however, this frequency can be expressed as $\cos(WcT + \phi)$, where

$Wc = (44 - 1/8)f_H \times 2\pi$

ϕ represents the phase shift at the early stage, and is not a function of time

$$\cos(WcT + \phi) = \cos[2\pi(44 - 1/8)f_H \cdot t + \phi]$$
$$= \cos(2\pi \cdot 44 \cdot f_H \cdot t - 2\pi \cdot 1/8 \cdot f_H \cdot t + \phi)$$

In the above equation, assuming that t is the unit for the time period of one horizontal scan, the time function of the component, $2\pi \cdot 44 \cdot f_H \cdot t$, is not related to the phase shift. In addition, because ϕ is the constant which represents the phase at the early stage, it does not produce the phase shift as a function of time. The remaining component, $2\pi \cdot 1/8 \cdot f_H \cdot t$, is the part concerned with the phase shift as a function of time.

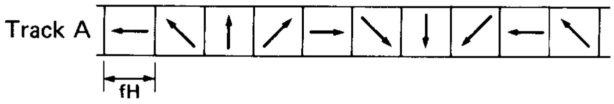
In order to simplify this equation, focus is centred only on the component $2\pi \cdot 1/8 \cdot f_H \cdot t$, which is related to the phase shift as a function of time.

When $t = \frac{1}{f_H}$ (looking at the phase shift of each horizontal scan period):

$$2\pi \cdot 1/8 \cdot f_H \cdot t = 2\pi \cdot 1/8 \cdot f_H \cdot \frac{1}{f_H} = \frac{2\pi}{8} = \frac{\pi}{4}$$

In other words, the phase shift of each horizontal scanning line of track A which is converted to the low frequency range and then recorded on the tape shifts $\frac{\pi}{4}$ each time.

This can be illustrated as:

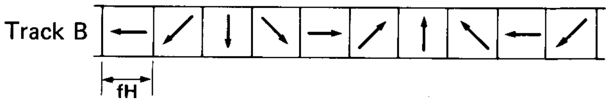


As can be seen, the phase shifts clockwise $\frac{\pi}{4}$ at each horizontal scanning period.

The equation for the chrominance signal phase converted to the low frequency range and recorded on track B is:

$$\cos(WcT + \phi) = \cos[(44 + 1/8)f_H \cdot t + \phi]$$

The phase shifts anti-clockwise $\frac{\pi}{4}$ at each horizontal scanning period. Again, this can be illustrated as:



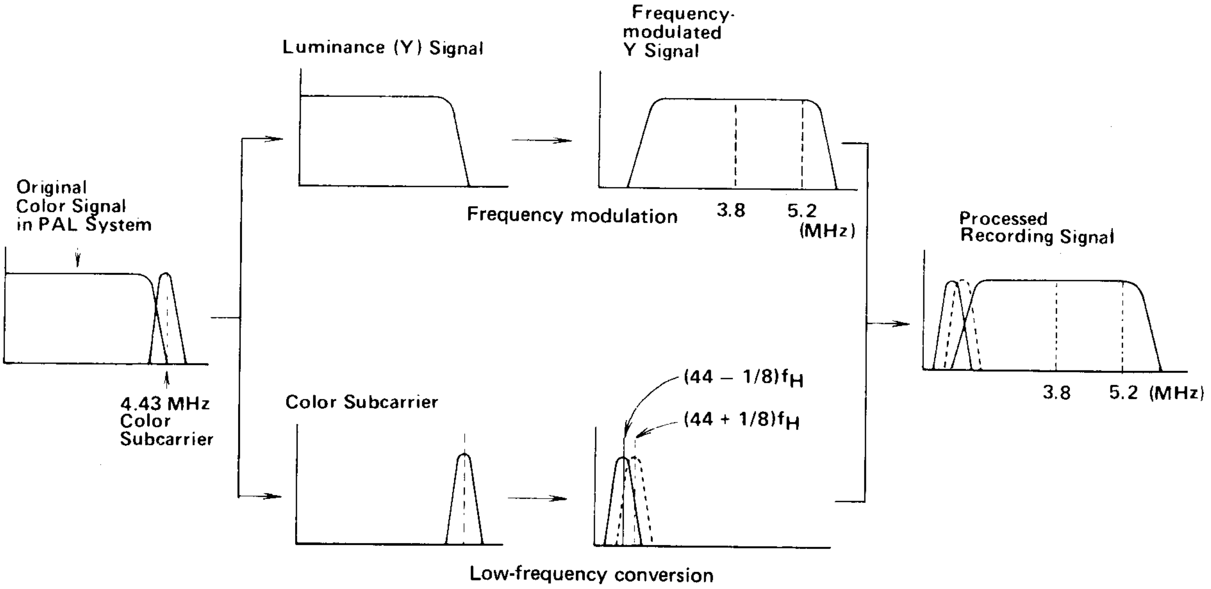


Fig. 2-1-5 Frequency distribution of original recording signal and processed signal

b. Elimination of the colour crosstalk component

Next, an explanation is given with regard to how the crosstalk from an adjacent track is eliminated based on the actual encoding on the magnetic tape.

Fig. 2-1-6 shows the correlation of the actual encoded chrominance signal phase. An explanation will now be given concerning how the crosstalk from the adjacent track A is eliminated during playback of track B. First, it can be observed in the illustration that the phase of the recorded chrominance signal for both track A and track B shifts only $\frac{\pi}{2}$ at every 2H (2 horizontal scanning periods). By making use of this, the crosstalk can be eliminated by passing it through a comb filter. An explanation will now be given concerning this phase shift at every 2H.

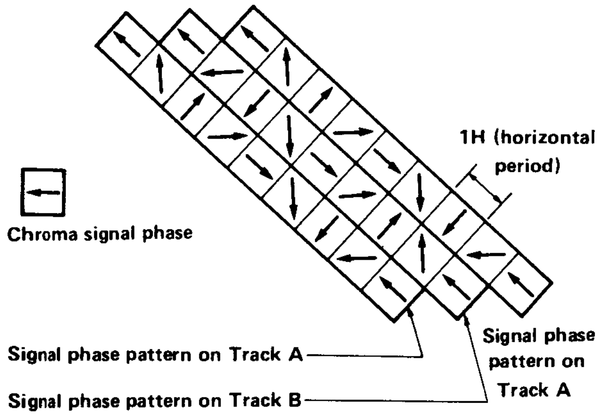

1H (horizontal period)
Chroma signal phase
Signal phase pattern on Track A
Signal phase pattern on Track B
Signal phase pattern on Track A

Fig. 2-1-6 Chrominance signal phase pattern recorded on each track

Fig. 2-1-7 is a simple illustration of the phase relationship between the playback chrominance signal and the crosstalk signal, and shows that the idler frequency of 4.43 MHz + $(44 \pm 1/8)f_H$ is for returning the low-frequency-converted chrominance signal being played back to the 4.43-MHz chrominance playback signal.

Fig. 2-1-8 shows the elimination of the crosstalk from the adjacent track by passing the signals through a comb filter. When the signal that passes through the 2H delay line is added to the signal that does not, the signal components can be added because they are in-phase; however, because the crosstalk components are phase inverted every 2H, they cancel each other and both are eliminated. In order to simplify the explanation it was omitted, but actually, because the phase of the colour subcarrier wave is inverted every 2H because of the 1/4 line offset of equation (2) (refer to section II-A-3. "PAL System Subcarrier Frequency"), the direction of the true signal and that of the crosstalk in Fig. 2-1-8 are reversed. It follows, therefore, that the crosstalk can be cancelled by subtracting b from a.

c. AFC and APC loops

To eliminate phase fluctuation of the chrominance signal due to jitter, etc., occurring in the recording and playback process, new APC (Automatic Phase Control) and AFC (Automatic Frequency Control) systems have been adopted.

In a conventional VCR, phase fluctuations are eliminated primarily by the APC circuit. The AFC circuit utilizes the playback horizontal synchronizing signal to detect large variations in the tape speed (such as during the "slow" and "still" modes), shifts the operating point of the APC circuit, and widens the APC locking range.

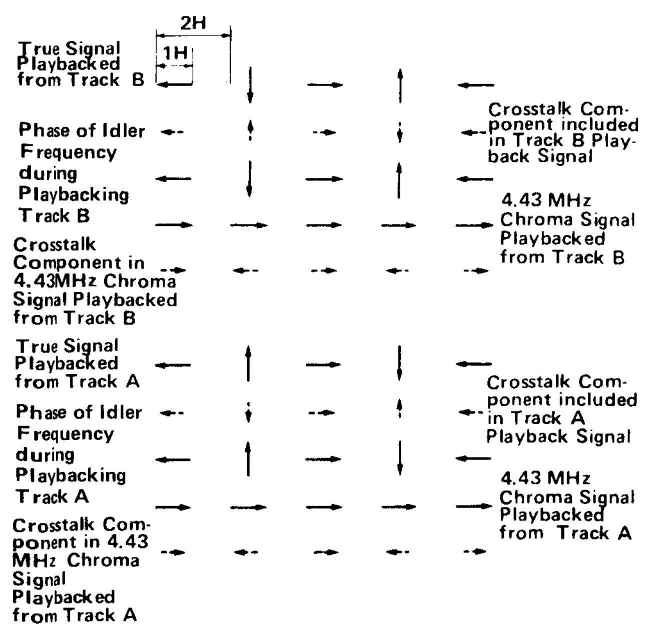

2H
1H
True Signal Playbacked from Track B
Phase of Idler Frequency during Playbacking Track B
Crosstalk Component in 4.43MHz Chroma Signal Playbacked from Track B
Crosstalk Component included in Track B Playback Signal
4.43 MHz Chroma Signal Playbacked from Track B
True Signal Playbacked from Track A
Phase of Idler Frequency during Playbacking Track A
Crosstalk Component in 4.43 MHz Chroma Signal Playbacked from Track A
Crosstalk Component included in Track A Playback Signal
4.43 MHz Chroma Signal Playbacked from Track A

Fig. 2-1-7 Relationship between playback chrominance signal and crosstalk component

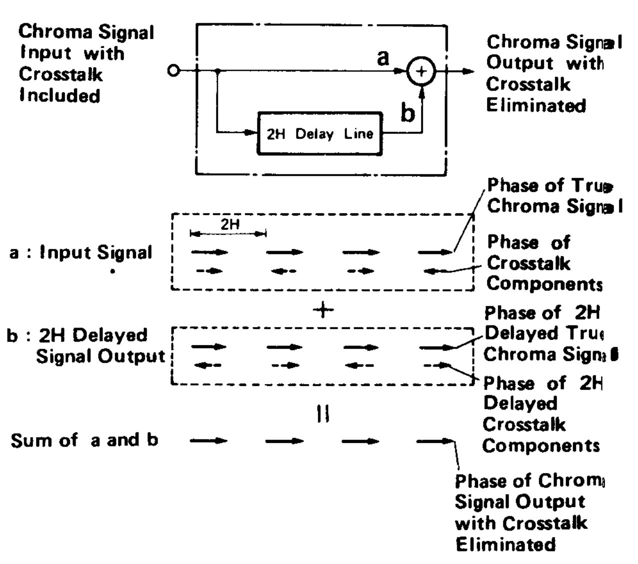

Chroma Signal Input with Crosstalk Included
a
b
+
2H Delay Line
Chroma Signal Output with Crosstalk Eliminated
2H
a : Input Signal
b : 2H Delayed Signal Output
Sum of a and b
+
=
Phase of True Chroma Signal
Phase of Crosstalk Components
Phase of 2H Delayed True Chroma Signal
Phase of 2H Delayed Crosstalk Components
Phase of Chroma Signal Output with Crosstalk Eliminated

Fig. 2-1-8 Comb filter function

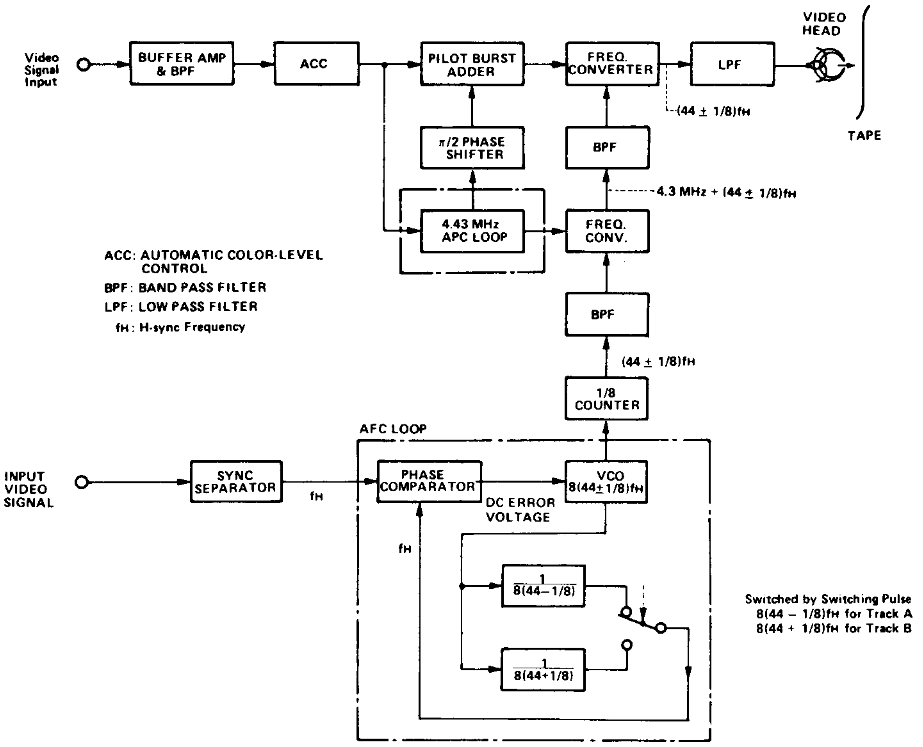

Video Signal Input
BUFFER AMP & BPF
ACC
PILOT BURST ADDER
FREQ. CONVERTER
LPF
VIDEO HEAD
TAPE
(44 ± 1/8)fH
π/2 PHASE SHIFTER
BPF
4.3 MHz + (44 ± 1/8)fH
4.43 MHz APC LOOP
FREQ. CONV.
ACC: AUTOMATIC COLOR-LEVEL CONTROL
BPF: BAND PASS FILTER
LPF: LOW PASS FILTER
fH: H-sync Frequency
BPF
(44 ± 1/8)fH
1/8 COUNTER
AFC LOOP
INPUT VIDEO SIGNAL
SYNC SEPARATOR
fH
PHASE COMPARATOR
VCO 8(44±1/8)fH
DC ERROR VOLTAGE
fH
1/8(44–1/8)
1/8(44+1/8)
Switched by Switching Pulse
8(44 – 1/8)fH for Track A
8(44 + 1/8)fH for Track B

Fig. 2-1-9 Block diagram of the AFC and APC loops during the REC mode

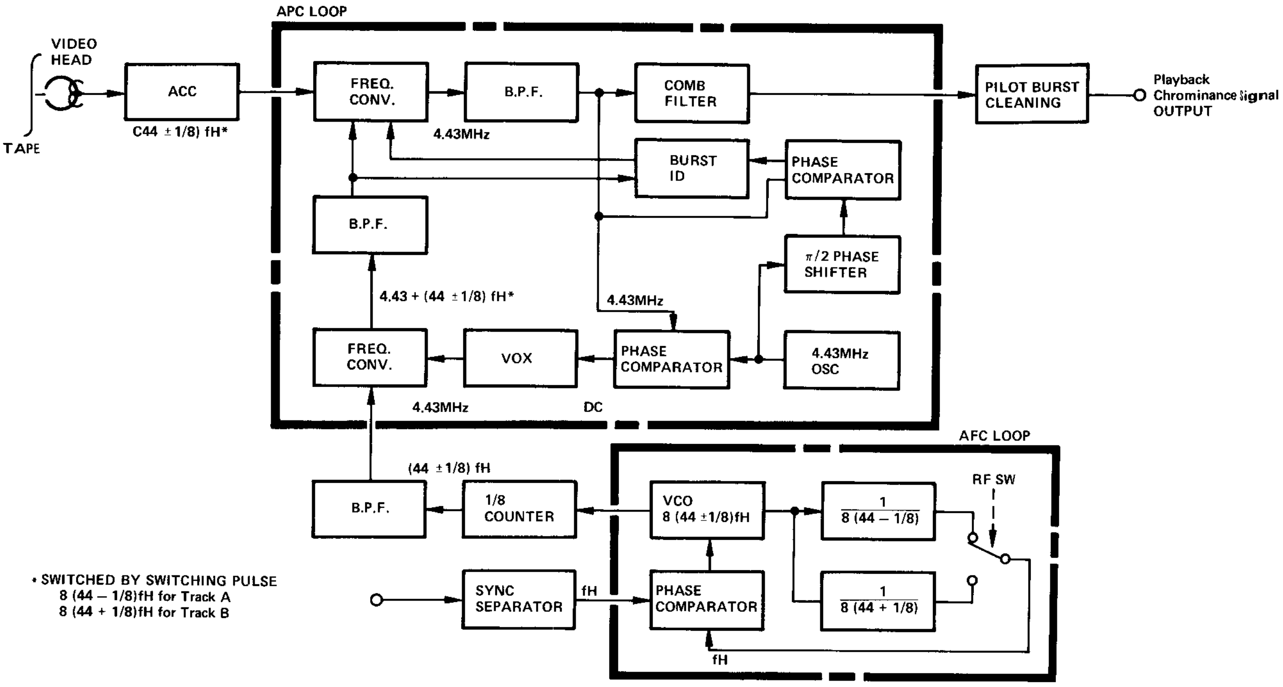

APC LOOP
VIDEO HEAD
TAPE
ACC
C44 ±1/8) fH*
FREQ. CONV.
B.P.F.
COMB FILTER
PILOT BURST CLEANING
Playback Chrominance Signal OUTPUT
4.43MHz
BURST ID
PHASE COMPARATOR
B.P.F.
π/2 PHASE SHIFTER
4.43 + (44 ±1/8) fH*
4.43MHz
FREQ. CONV.
VOX
PHASE COMPARATOR
4.43MHz OSC
4.43MHz
DC
AFC LOOP
(44 ±1/8) fH
B.P.F.
1/8 COUNTER
VCO 8 (44 ±1/8)fH
1/8 (44 – 1/8)
RF SW
SYNC SEPARATOR
fH
PHASE COMPARATOR
1/8 (44 + 1/8)
fH
* SWITCHED BY SWITCHING PULSE
8 (44 – 1/8)fH for Track A
8 (44 + 1/8)fH for Track B

Fig. 2-1-10 Block diagram of the AFC and APC loops during the PLAY mode

As previously mentioned, the frequency of the chrominance signal converted to a low frequency range is changed to a frequency of $(44 \pm 1/8)f_H$, which is the frequency which is synchronized with the horizontal synchronizing signal frequency (f_H) of the video input signal.

The following is an explanation of the processing of the chrominance signal in the REC mode as shown in Fig. 2-1-9: The PAL chrominance burst signal phase swings alternately $+135^\circ$ and -135° each 1H. Because of this, it is difficult to use this burst signal to compose the APC loop during playback. Consequently, a 4.43-MHz continuous wave which undergoes automatic phase control (APC) is added to the input chrominance signal burst phase as a pilot burst, and this pilot burst is used to compose the APC loop during playback.

The chrominance signal frequencies converted to a low frequency range during recording are changed to $(44 - 1/8)f_H$ for track A and $(44 + 1/8)f_H$ for track B; however, this is obtained by the following process:

A signal 351 times (for track A) and one 353 times (for track B) the horizontal synchronizing signal is generated by an $8(44 \pm 1/8)f_H$ VCO (Voltage Controlled Oscillator), and then the sum frequency of the 1/8 counted down $(44 \pm 1/8)f_H$ of the VCO and the 4.43-MHz crystal oscillator output (which is automatic phase controlled to the input chrominance signal) is used as the frequency conversion carrier (the idler frequency).

The VCO output is counted down 1/351 for track A and 1/353 for track B, and then the AFC loop compares the phase with the horizontal synchronizing signal, and uses the voltage difference to control the VCO.

[This type of circuit is essentially a PLL (Phase-Locked Loop); however, it is usually called AFC in the television industry and, therefore, will be called the AFC loop herein.]

The above mentioned frequency relationship is maintained, and the chrominance signal and the Y-FM signal are recorded on the tape.

When a signal which has been recorded this way is played back, the phase fluctuation of the horizontal synchronizing signal of the playback video signal can be thought to be essentially equivalent to the phase fluctuation of the playback $(44 \pm 1/8)f_H$ kHz chrominance signal divided by $(44 \pm 1/8)$.

During playback, just as during recording, a signal which results from multiplying the repeating frequency of the playback horizontal synchronizing signal by $(44 \pm 1/8)$ is generated by the AFC loop. The sum frequency (the idler frequency) and the crystal oscillator output (which is the 4.43 APC frequency) cancels out the phase fluctuation of the chrominance signal through the process of frequency conversion. (Refer to Fig. 2-1-10.)

During recording, the APC loop generates the 4.43-MHz continuous wave which is automatic phase controlled to the input chrominance signal burst phase, and this is recorded as the pilot burst. During playback, this pilot burst is detected, and serves as the reference signal to compose the APC loop. The reason for locking the pilot burst phase is so that the automatic phase control of the chrominance signal can be done easily during still frame playback.

d. Pilot burst signal

Because the necessity of the pilot burst in the PAL BETACORD system was explained in section c, it will not be repeated; however, the position and level for the addition of the pilot burst is shown below.

The pilot burst signal for use in automatic phase control is added at the level of either 80% of the chrominance signal or approximately 1.6 times the colour burst signal.

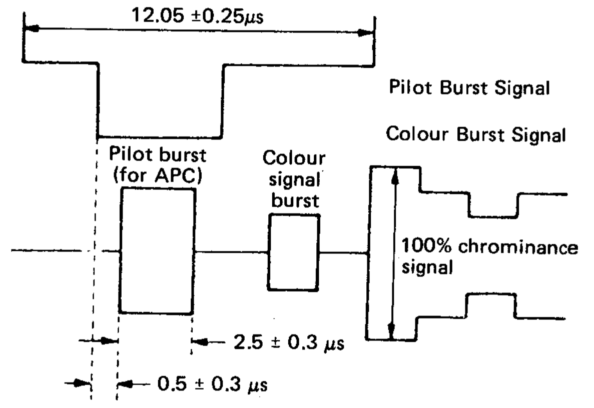


Fig. 2-1-11 Pilot burst signal

C. VIDEO CIRCUIT

1. Video System Circuitry

The video system circuit is composed of the VD-1 circuit board and the VD-2 circuit board. The portion of the video circuit on the VD-1 circuit board is composed of the RF recording/playback amplifier and the luminance signal (Y) recording/playback processing circuit.

The portion of the video circuit on the VD-2 circuit board is composed of the chrominance signal recording/playback processing circuit.

In addition, the video circuit is composed of the following ICs:

Luminance signal system:	CX-134A, HA11701, HA11703, and LA7013
Chrominance signal system:	CX-136A, CX-832, CX-150, MB14300, and TC4053
Frequency conversion system:	CX-832 and MB14300

2. Video Signal Circuitry

a. Luminance signal processor circuit

The luminance signal (Y) circuit uses four ICs: CX-134A, HA11701, HA11703, and LA7013.

The function of each IC is listed below:

CX-134A (Q1501) comprises a pre-amplifier, a limiter, a dropout compensator circuit, and an RF switch.

HA11701 (Q1003) is the IC for recording of the luminance signal, and comprises a frequency modulator, an AGC amplifier, and a clamping circuit.
HA11703 (Q1001) is the IC for playback of the luminance signal, and comprises a frequency demodulator, a noise canceler, and a luminance/chrominance mixing amplifier.
LA7013 (Q1004) comprises a luminance signal comb noise canceler, a frequency modulator, a limiter, and an adder circuit.
The block diagram for the luminance signal processor circuit is shown in Fig. 2-1-12.

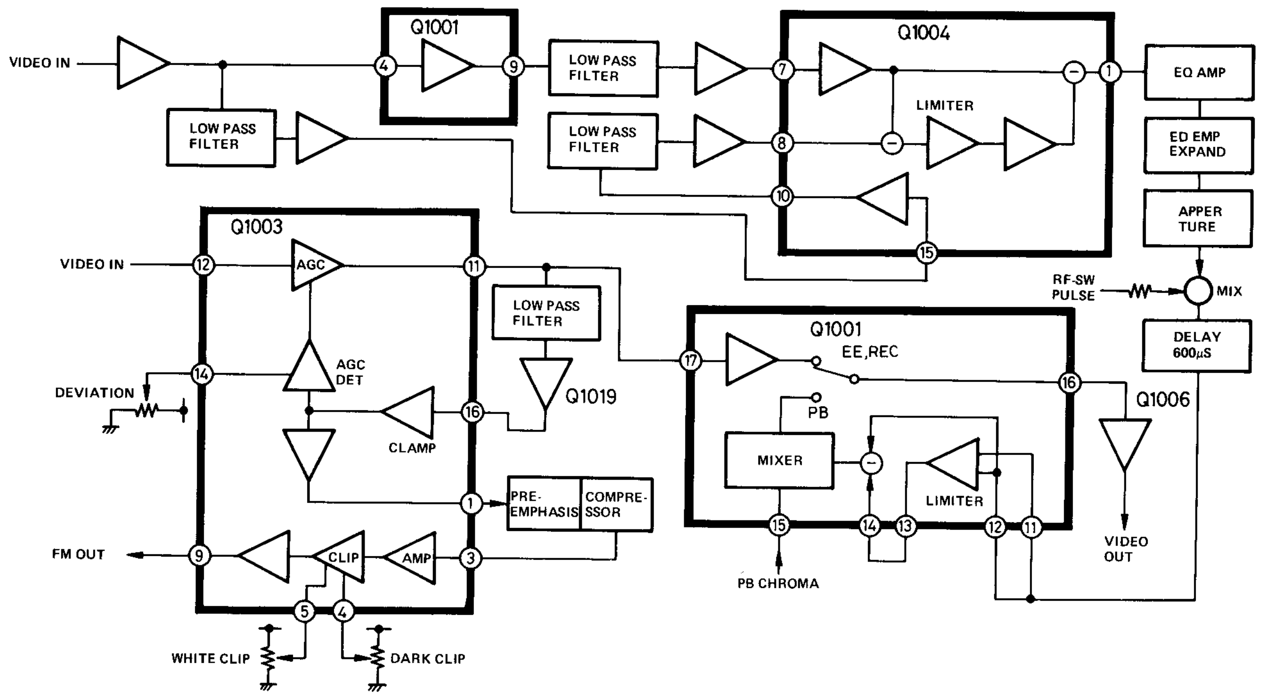

VIDEO IN
Q1001
4
9
LOW PASS FILTER
LOW PASS FILTER
LOW PASS FILTER
Q1004
7
8
10
15
1
LIMITER
EQ AMP
ED EMP EXPAND
APPER TURE
RF-SW PULSE
MIX
DELAY 600µS
Q1006
VIDEO OUT
VIDEO IN
Q1003
12
AGC
11
LOW PASS FILTER
Q1019
AGC DET
14
DEVIATION
16
CLAMP
1
PRE-EMPHASIS
COMPRESSOR
FM OUT
9
CLIP
AMP
3
5
4
WHITE CLIP
DARK CLIP
Q1001
17
EE,REC
PB
16
MIXER
LIMITER
15
14
13
12
11
PB CHROMA

Fig. 2-1-12 Luminance Signal Processor Circuit Block Diagram

(1) AGC (Automatic Gain Control)

The amplitude of the luminance component of the video signal input is made constant by the AGC circuit of Q1003, and the DC level of the sync tip is clamped by the clamping circuit. This is done in order to fix the input level and operating point of the frequency modulator. There are two systems in the AGC; one is the sync AGC and the other is the peak AGC.
The synchronizing signal remains unchanged regardless of the contents of the broadcast; therefore, it is detected in order to be used to control the AGC amplifier. This system is called the sync AGC. The detection of the synchronizing signal is accomplished by raising the horizontal blanking level of the video signal and detecting its peak.
However, at times, the V/S ratio (normally 7:3) may change in instances where the white level exceeds 100%, the synchronizing level falls due to broadcasting conditions, etc. Because such an occurrence would result in overmodulation, the peak AGC circuit comes into operation when the white level exceeds 100%.
The video signal enters pin (12) of Q1003, passes through the AGC amplifier, and is output from pin (11).
R1074 and C1052 compose the peak hold circuit for the sync AGC. The peak AGC operation is performed within Q1003.

(2) Pre-emphasis

Generally, the higher the modulation frequency of an FM wave, the more likely it is to be affected by noise; therefore, by first amplifying the high frequency component within the input signal and increasing the degree of modulation, the noise effect can be reduced. In addition, the S/N ratio is improved by increasing the degree of modulation when the input amplitude is small and decreasing it when the input amplitude is great. (Refer to Fig. 2-1-13.)
This is called the "non-linear emphasis" or "compressor" circuit.
As shown in Fig. 2-1-14, in regard to the video signal waveform, this circuit suppresses the shooting of the large high-amplitude portion, then restores it during playback. The emitter side of Q1026 shown in Fig. 2-1-15 is the pre-emphasis constant, and the collector side is the

non-linear pre-emphasis circuit. Utilizing the non-linear characteristic of the diode, the suppression effect of becomes stronger as the amplitude increases. The signal passes through Q1025, Q1024, and Q1023, and the dark shooting and the white shooting are limited within Q1003, thus preventing over-modulation. This signal is next converted to an FM signal in the frequency modulator, and sent to the recording amplifier.

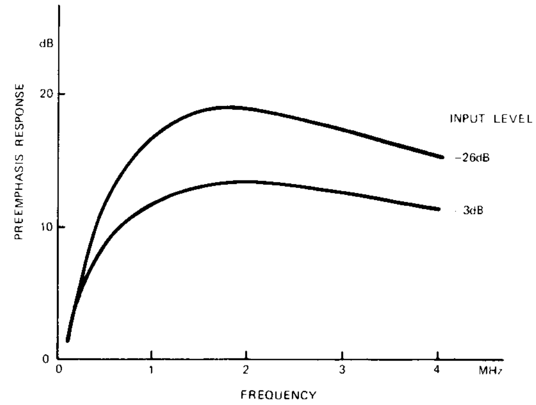


Fig. 2-1-13 Pre-emphasis characteristics

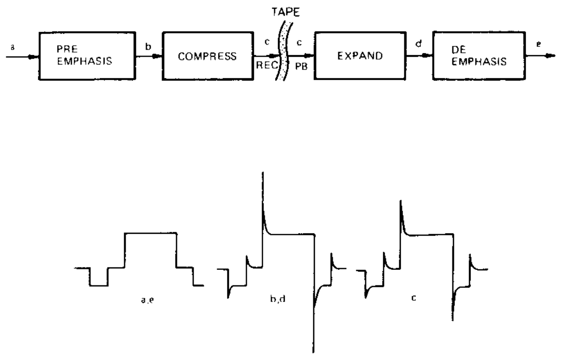
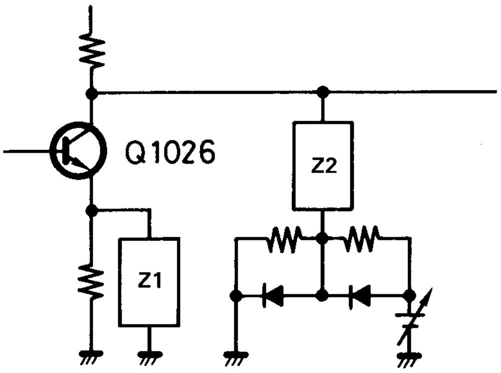


Fig. 2-1-14 Non-linear emphasis operation



Z1: Pre-emphasis impedance
Z2: Non-linear impedance

Fig. 2-1-15 Pre-emphasis circuit

(3) Frequency modulator

The frequency modulator makes use of an astable multivibrator, which determines the frequency through the use of C1049, which is connected to pin (7) and pin (8) of Q1003. The oscillation frequency is determined by VR1007 and the duty cycle is determined by VR1006. By having the FM signal output from pin (9) of Q1003 pass through the H.P.F., it is possible to prevent interference with the colour subcarrier recording signal which is converted to a low frequency range during the colour mode.

(4) Recording amplifier

In the luminance recording amplifier Q1507 ~ Q1510 of the VD-1 pre-amplifier section, the luminance FM signal from the VD-1 video section is amplified to a voltage sufficient to drive the video head. The recording chrominance signal (688 kHz) from VD-2 is power amplified by Q1511, mixed with the luminance FM signal in the resistance mixing circuit (R1554 and R1555), and then both signals are sent to the video head.

(5) Playback amplifier and dropout compensator circuit (DOC)

Q1501 is composed of the playback pre-amplifier, the RF switcher, the limiter, and the dropout compensator circuit. After the output from the video head has been sufficiently amplified and the frequency response corrected, the luminance FM signal undergoes amplitude limitation in the limiter and is supplied to the demodulation circuit. The block diagram is shown in Fig. 2-1-16. The pre-amplifier and RF switcher have two channels corresponding to video head A and video head B, and, because both channels have the same structure, channel A will be used as an example herein.

The faint signal output from the video head passes through the rotary transformer and the step-up transformer (T1501), and is supplied to the FET amplifier Q1502. Q1502 is connected to the amplifier inside the IC, and this composes a cascode amplifier. The power supply to the pre-amplifier section is DC +6V, which has been stepped down from DC +12V by R1535. In addition, in order to stabilize the IC, the power supply is bled by R1539. The output of the cascode amplifier passes through the emitter follower, and is supplied to the equalizer amplifier. The equalizer circuit is composed of L1510, C1524, and VR1503, which are connected to pin (20). In this circuit, middle-frequency-range correction at approximately 4.5 MHz is carried out. Balance adjustment is done by VR1506 so that the pre-amplifier outputs of both channels become equal.

The output from the equalizer amplifier is supplied to the RF switching circuit. A 25-Hz switching pulse, created by the 25 PG pulses A and B, is applied from the servo system to pin (18).

On the channel A side, when pin (18) is OFF, pin (20)

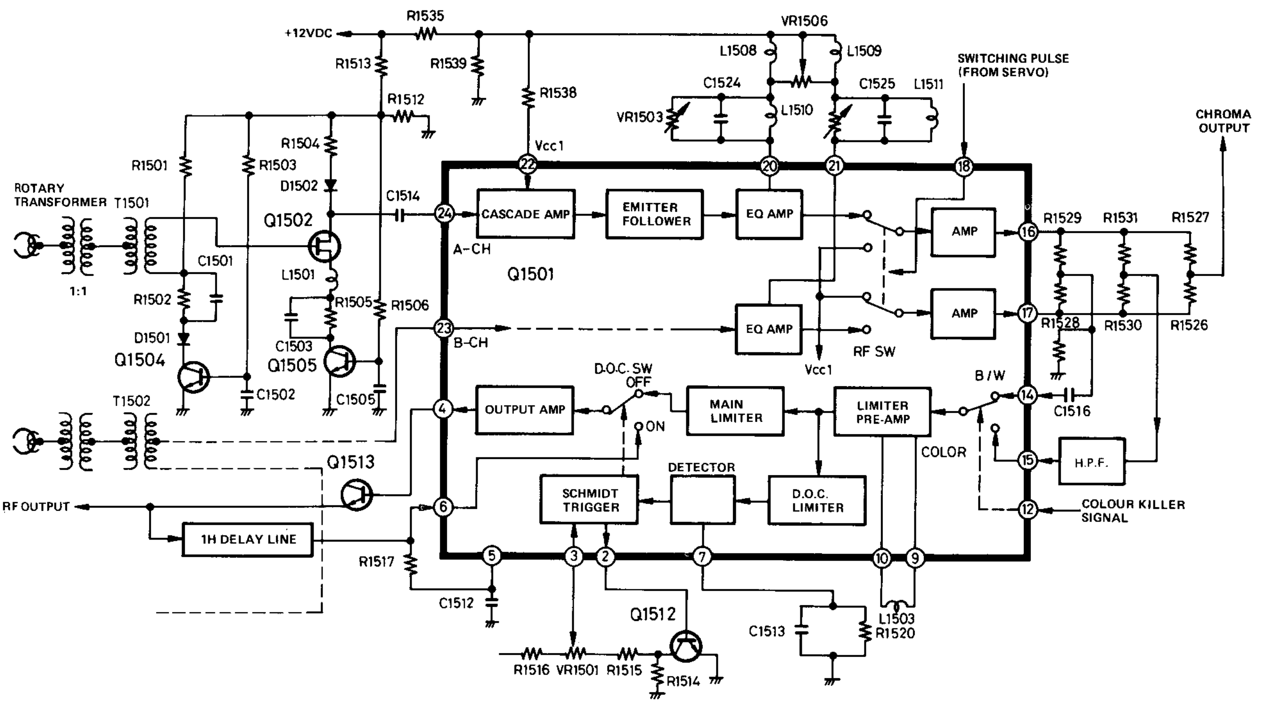

R1535
+12VDC
VR1506
R1513
R1539
L1508
L1509
SWITCHING PULSE (FROM SERVO)
R1512
R1538
C1524
C1525
L1511
VR1503
L1510
CHROMA OUTPUT
R1504
Vcc1
R1501
R1503
ROTARY TRANSFORMER T1501
D1502
C1514
EMITTER FOLLOWER
EQ AMP
CASCADE AMP
Q1502
AMP
R1529
R1531
R1527
A-CH
C1501
Q1501
1:1
L1501
R1502
R1505
R1506
AMP
D1501
EQ AMP
B-CH
R1528
R1530
R1526
C1503
Q1504
Q1505
RF SW
D.O.C. SW
OFF
Vcc1
B/W
T1502
C1502
C1505
OUTPUT AMP
MAIN LIMITER
LIMITER PRE-AMP
C1516
ON
COLOR
Q1513
DETECTOR
H.P.F.
SCHMIDT TRIGGER
D.O.C. LIMITER
RF OUTPUT
COLOUR KILLER SIGNAL
1H DELAY LINE
R1517
C1512
Q1512
L1503
C1513
R1520
R1516
VR1501
R1515
R1514
24
22
20
21
18
16
17
23
4
14
15
6
12
5
3
2
7
10
9

Fig. 2-1-16 Function diagram of Q1501 (CX-134A)

switches to the signal side, and when pin (18) becomes ON, pin (20) switches to the Vcc_1 power supply side. On the channel B side, the opposite occurs. Because of this, an RF signal from which the overlapping portion of both channels has been eliminated can be obtained. The output from the switching circuit passes through the amplifier and the emitter follower, and is output from pin (16) and pin (17).

The outputs of both channels from pin (16) and pin (17) are combined in the resistance mixing circuit, and become continuous output. The resistance mixing circuit is divided into three circuits:

(a) The RF signal which is mixed by R1526 and R1527 is supplied to the chrominance playback circuit on the VD-2 circuit board.

(b) The RF signal which is mixed by R1530 and R1531 passes through a high-pass filter (HPF), and is then supplied to the switching circuit of pin (15). In the high pass filter, the 688-kHz chrominance component of the playback RF signal is removed, and the luminance FM signal extracted.

(c) The RF signal which is mixed at R1528 and R1529 is supplied without change to pin (14), and becomes the switching circuit input for the black-and-white mode. For the colour/black-and-white switching circuit, pin (14) and pin (15) provide the signal input and pin (12) provides the switching voltage input.

A colour killer signal from Q1203 of the VD-2 circuit board is applied to pin (12). During the colour mode, a voltage of approximately DC +4 V is applied to pin (12), and the input signal of pin (15) becomes the switching output. During the black-and-white mode, pin (12) becomes 0 V, and the input signal of pin (14) becomes the switching output. After this, the Y-FM signal is supplied to the limiter and to the dropout compensator circuit (DOC).

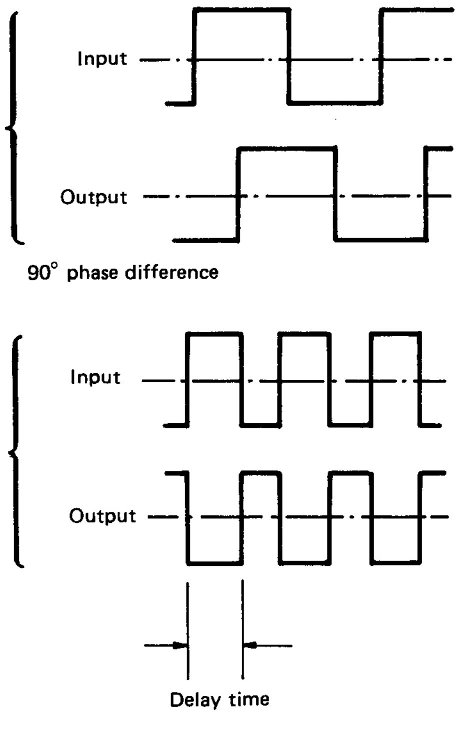
The Y-FM signal passes through the limiter pre-amplifier, and is applied to the main limiter and to the dropout compensator circuit. The purpose of the limiter pre-amplifier is to control waveform distortion caused by excessive input; it does not function as a limiter. In the main limiter, the amplitude of the Y-FM signal is limited by a limiter gain of approximately 25 dB, and amplitude fluctuation of the playback signal is eliminated. The output of the main limiter ordinarily passes through the DOC switch, and then through the output amplifier to be output from pin (4).

The output from pin (4) passes through the emitter follower Q1507, and is supplied to the de-modulation circuit of the VD-1 video section and the 1H delay line. The Y-FM signal applied to the 1H delay line is delayed by 1H and is supplied from pin (6) to the DOC switch. Prior to the detection in the stage, the DOC limiter acts at low strength on the signal to eliminate all but the dropout portion of the amplitude fluctuation component.

The output from the limiter passes to the detection stage, where the dropout is detected as a pulse. R1520 and C1513 of pin (7) form the smoothing circuit for the detection output. The detection output is applied to a Schmitt trigger, and is formed into a switching pulse. The sensitivity of the Schmitt trigger is varied by VR1501, thus regulating the dropout compensation sensitivity. The output from the Schmitt trigger is applied to the DOC switch as a switch operation signal. Because of this, the DOC switch operates where the dropout component exists, and the pre-1H delay signal is added to the dropout component. Q1512, which is connected to pin (2), switches ON and OFF in accordance with the dropout detection pulse, and, by shorting and opening R1514, produces an ON/OFF hysteresis effect for the DOC.

(6) Y-FM demodulator circuit Q1001

The playback Y-FM signal supplied from Q1501 of the pre-amplifier portion of the VD-1 circuit board is applied to Q1001. Q1001 uses a frequency demodulator circuit of the type called a multi-vibrator, in which a multi-vibrator is used as a delay circuit. The system uses an FM signal to injection-lock the astable multi-vibrator, and makes use of the fact that the phase difference between the FM signal input and the multi-vibrator output is proportional to the FM frequency. In the injection-lock, the delay time (phase difference) of the multi-vibrator is constant with regard to the FM signal input, regardless of the frequency. Because the delay time is constant, the phase difference of the input signal increases as the frequency becomes higher. (Refer to Fig. 2-1-17.)



F_0 = Multi-vibrator free-running frequency

Fig. 2-1-17 **Injection lock input and output signals**

If the free-running frequency of the multi-vibrator is F_0, then, when a signal of frequency F_0 is applied, the phase difference between the input and output will be 90°.

When a signal of frequency $2F_0$ is applied, the phase difference between the input and output will be 180°. The astable multi-vibrator is used as the frequency modulator during recording.

Because the input/output phase difference of the multi-vibrator is proportional to the input frequency, it is possible, through the use of a phase comparator (multiplier) to obtain a detected output proportional to the frequency.

This system is, in principle, a frequency modulator which is not affected by amplitude fluctuations of the FM signal; therefore, it is possible to greatly reduce the number of early section limiter stages.

(7) Y comb noise canceler circuit

If the signal and crosstalk spectrums are interleaved, this can be corrected by the use of a comb filter. During recording, an RF switching pulse (attenuated) is applied to the Y signal before modulation and the FM signal is interleaved between the tracks, and then during playback, this signal is passed through a 1H comb filter.

This theory of delay and addition is the same as that used in the colour signal comb filter. However, because the RF signal is frequency modulated and its spectrum is not interleaved, it is necessary that the addition operation be performed on the Y signal after de-modulation. The delay is of course carried out on the RF frequency. This comb filter works well only when the vertical correlation is large, in other words, only when two continuous scanning lines are the same signal. At any other time, because the signal is not interleaved, the comb filter also eliminates necessary information. In order to reduce this effect, the special circuit shown in Fig. 2-1-18 is used. Crosstalk Yc is obtained by direct and delayed Y subtraction. This Yc is passed through the limiter and subtracted from YDIR. Because the crosstalk signal is usually weak, it can be cancelled completely. Yc signals above a certain threshold are considered necessary information and are not cancelled.

(8) Noise canceler circuit

This circuit extracts the high frequency component of the video signal, applies the signal to the limiter to extract the noise component, and then applies this noise component in reverse phase to the original signal in order to cancel the noise.

The playback Y signal is applied to pin (12) and pin (11) of Q1001, and then the high frequency component of this playback Y signal is extracted, passed through the limiter, and output from pin (13). The high frequency component passes through the high-pass filter and is input from pin (14), and then is applied in the reverse phase of the playback Y signal from pin (12), thus cancelling the noise.

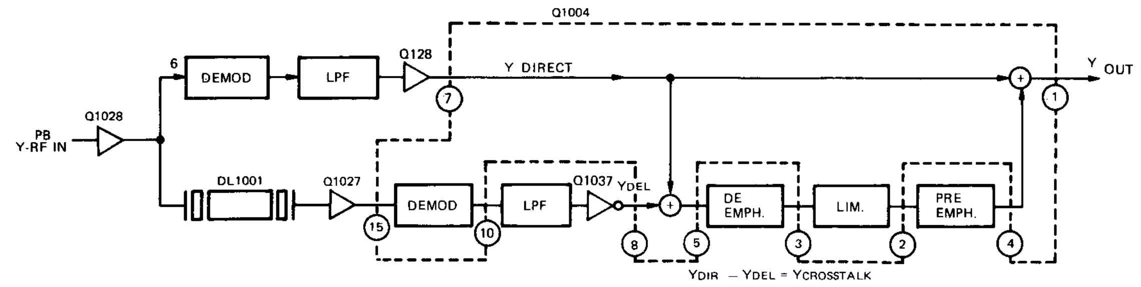

Q1004
6
DEMOD
LPF
Q128
Y DIRECT
Y OUT
7
1
Q1028
PB
Y-RF IN
DL1001
Q1027
DEMOD
LPF
Q1037
YDEL
DE EMPH.
LIM.
PRE EMPH.
15
10
8
5
3
2
4
YDIR – YDEL = YCROSSTALK

Fig. 2-1-18 Y comb filter block diagram

The noise canceler output is mixed with the chrominance signal from pin (15), passes through a switch, is output from pin (16), passes through the buffer Q1006, is input to pin (18), passes through the amplifier, is extracted from pin (20), and finally is supplied to the video output circuit.

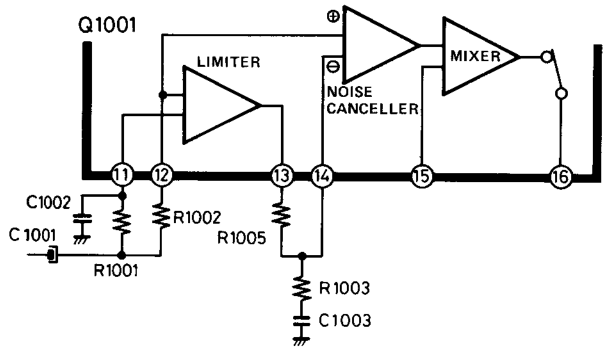

Q1001
LIMITER
⊕
⊖
NOISE CANCELLER
MIXER
11
12
13
14
15
16
C1002
C1001
R1001
R1002
R1005
R1003
C1003

Fig. 2-1-19 Noise canceler circuit

(9) De-emphasis

The output of the Y comb filter, after undergoing phase compensation by the Q1034 low-pass filter, passes through the emitter follower of Q1033, thus causing the high-frequency component, which was emphasized by the pre-emphasis during recording, to be damped by the de-emphasis circuit of Q1017. (Refer to Fig. 2-1-20.) First, in the emitter side non-linear emphasis (expander) circuit, composed of Z_2, D1001, and D1002, the suppressed high amplitude portion shooting is restored, and then de-emphasis is applied by Z_1 of the collector side. The noise occurring in the chrominance range during the colour mode is blocked by the 4.43-MHz trap composed of L1007 and C1032. Q1014 and Q1015 compose the aperture circuit, and, using the delay time of L1006 and C1029, the contrast is sharpened.

The output of Q1015 is amplified by Q1013, Q1012, and Q1011; however, at this time, the RF switching pulse is added to cancel the 1/2H shift portion obtained during recording. The output of Q1011 is delayed by 0.6 micro-

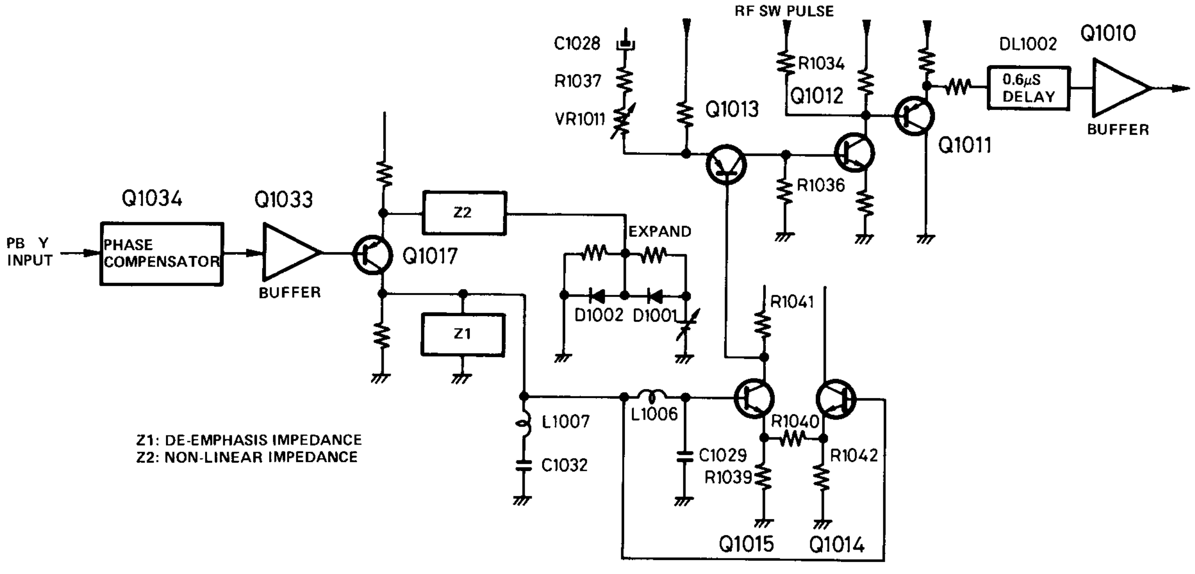

RF SW PULSE
C1028
R1037
VR1011
Q1013
R1034
Q1012
DL1002
Q1010
0.6μS DELAY
BUFFER
Q1011
R1036
Q1034
Q1033
PB Y INPUT
PHASE COMPENSATOR
BUFFER
Q1017
Z2
EXPAND
Z1
D1002
D1001
R1041
L1007
L1006
C1032
C1029
R1039
R1040
R1042
Q1015
Q1014
Z1: DE-EMPHASIS IMPEDANCE
Z2: NON-LINEAR IMPEDANCE

Fig. 2-1-20 De-emphasis circuit

seconds by DL1002 in order to achieve phase matching with the chrominance signal.

(10) Video output circuit

During the REC EE mode, the video signal which passes through the AGC circuit enters pin (17) of Q1001, passes through the switch within Q1001, and is extracted from pin (16).

During the PLAY mode, the playback chrominance signal processed by the chrominance system in the VD-2 circuit board enters pin (15) of Q1001, and a playback Y signal processed within the VD-1 circuit board enters pin (14) of Q1001. These two signals are mixed by the mixer, and, passing through the switch, are extracted from pin (16) of Q1001. The switch within Q1001 is controlled by the PB + 12 V input of pin (8). During the REC EE mode, the EE amp and pin (16) are connected, while during the PLAY mode, the colour mixer and pin (16) are connected.

The output from pin (16) of Q1001 passes through the buffer, enters pin (18), passes through the amplifier, is output from pin (20), and is then sent to the LINE OUT terminal through Q1008 and also to the RF converter through Q1007. Pin (19) of Q1001 uses the muting circuit input to cancel the picture during the PLAY mode in the event that there is no control signal. (Refer to Fig. 2-1-21.)

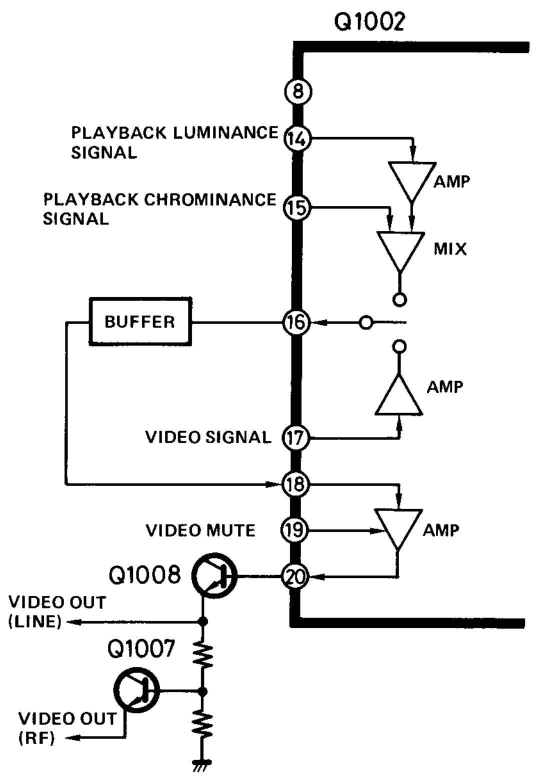


Fig. 2-1-21 Video output block diagram

b. Chrominance signal system circuitry (Refer to Fig. 2-1-22.)

Recording of the chrominance signal is done by the low frequency range conversion direct recording method. Because the recording pattern on the tape does not have a guard, the recording frequencies of the tracks are only 1/4 f_H apart, and during playback crosstalk from the adjacent track is eliminated by a comb filter. Therefore, the frequency of the chrominance signal which has been converted to a low frequency range is synchronized with the frequency of the horizontal-synchronizing signal of the video input signal.

The phases of the colour burst of the PAL signal vary by 90° each scanning line; therefore, when the APC is applied, the capture range is approximately half that of the NTSC system. Therefore, it requires many times as long for the APC to stabilize after head switching as it does for the NTSC system. To cope with this problem, a pilot burst (or quasi-burst) is added to the horizontal synchronizing period. This creates a stabilized system in which the APC converges rapidly. In order to preserve the continuity of the JOG mode, the pilot burst phase is locked to the input sub-carrier.

(1) REC mode

First, a pilot burst is added to the horizontal synchronizing period of the 4.43-MHz input chrominance signal. This utilizes a 4.43-MHz signal obtained from the APC loop and locked into the input chrominance signal. The chrominance signal to which the pilot burst has been added is applied to the frequency converter.

A carrier signal of 5.12 MHz [4.43 MHz + $(44 \pm 1/8)f_H$] is applied to the frequency converter, and here the chrominance signal is converted to a frequency of $(44 \pm 1/8)f_H \fallingdotseq 688$ kHz. The carrier signal is formed in the following manner:

During recording, a frequency of $(44 \pm 1/8)f_H$ is produced by the AFC loop from the horizontal synchronizing signal obtained by synchronizing separation of the video input signal (f_H = horizontal synchronous frequency). This is a PLL (Phase-Locked Loop) circuit. The output (approximately $8 \times 44\ f_H$) of the voltage control oscillator (VCO) is counted down by 1/351 for track A and 1/353 for track B. It is then phase-compared with the horizontal synchronizing signal, and the oscillator is controlled by the voltage difference. In this way a signal of $8(44 \pm 1/8)f_H = (352 \pm 1)f_H$ which is synchronized with the horizontal synchronizing signal frequency of the video input signal is obtained.

Next, when this VCO output is 1/8 frequency divided, the $(44 \pm 1/8)f_H$ signal is obtained. The output of the frequency divider is applied to the frequency conversion circuit. The 4.43-MHz output of the crystal oscillator is applied to the frequency conversion circuit; however, this frequency is locked to the chrominance signal in the following manner.

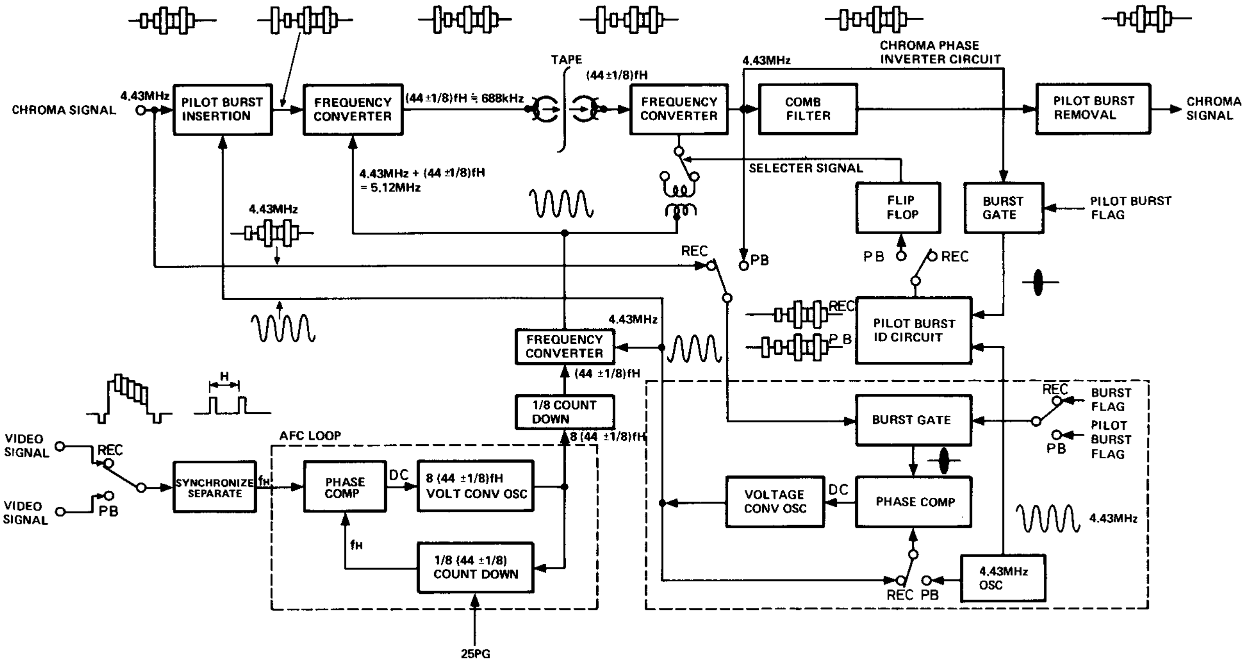

TAPE
(44±1/8)fH
4.43MHz
CHROMA PHASE INVERTER CIRCUIT
CHROMA SIGNAL
4.43MHz
PILOT BURST INSERTION
FREQUENCY CONVERTER
(44±1/8)fH ≒ 688kHz
FREQUENCY CONVERTER
COMB FILTER
PILOT BURST REMOVAL
CHROMA SIGNAL
4.43MHz + (44 ±1/8)fH = 5.12MHz
SELECTER SIGNAL
FLIP FLOP
BURST GATE
PILOT BURST FLAG
4.43MHz
REC
PB
PB
REC
REC
PB
PILOT BURST ID CIRCUIT
4.43MHz
FREQUENCY CONVERTER
(44 ±1/8)fH
H
1/8 COUNT DOWN
8 (44 ±1/8)fH
VIDEO SIGNAL
REC
AFC LOOP
SYNCHRONIZE SEPARATE
fH
PHASE COMP
DC
8 (44 ±1/8)fH VOLT CONV OSC
fH
1/8 (44 ±1/8) COUNT DOWN
VIDEO SIGNAL
PB
25PG
REC
BURST FLAG
PILOT BURST FLAG
PB
BURST GATE
VOLTAGE CONV OSC
DC
PHASE COMP
4.43MHz
4.43MHz OSC
REC PB

Fig. 2-1-22 Chrominance system block diagram

The output of the 4.43-MHz voltage controlled crystal oscillator (VXO) and the phase of the burst extracted from the input chrominance signal are compared, and the phase difference is converted to a direct current (DC) to control the VXO. An output of 4.43 MHz + (44 ± 1/8)f_H = 5.12 MHz is obtained in the frequency converter output. This 5.12-MHz output is supplied to the chrominance frequency converter for both the recording and playback sides.

As a result, the frequency of the chrominance signal which is converted to 688 kHz becomes (44 ± 1/8)f_H and synchronized in relation to the horizontal synchronizing signal frequency which is recorded. (+1/8 is for track B and -1/8 is for track A.) In this way, the chrominance signal which is converted to 688 kHz is recorded onto the tape together with the FM signal.

(2) PLAY mode

The 688-kHz chrominance signal separated from the playback output of the video head is frequency converted to 4.43 MHz by the frequency converter. A 5.12-MHz carrier signal is applied to the frequency converter from the same circuit that is used during recording.

During the PLAY mode, the input signal of the AFC loop becomes the horizontal synchronizing signal separated from the playback video signal. In addition, the input signal of the APC loop during the PLAY mode becomes the pilot burst separated from the chrominance signal. However, during recording, the chrominance signal is recorded at the frequency of (44 ± 1/8)f_H which is synchronized with the horizontal synchronizing signal (f_H). In this way, when a recorded signal is played back, the relationship of the phase fluctuation (Δf_H) of the horizontal synchronizing signal of the playback video signal to the phase fluctuation (Δf_L) of the playback chrominance signal becomes Δf_L = (44 ± 1/8)Δf_H.

The (44 ± 1/8)f_H output synchronized with the playback horizontal synchronizing signal is obtained in the AFC loop, and includes the (44 ± 1/8)Δf_H phase fluctuation. This signal becomes the carrier signal which frequency converts the playback chrominance signal to 4.43 MHz. This can be expressed as: 4.43 MHz + (44 ± 1/8)(f_H + Δf_H). Because the playback chrominance signal is f_L + Δf_L = (44 ± 1/8)Δf_H + (44 ± 1/8)Δf_H, the difference between this and the previous equation causes the phase fluctuation component to be canceled in the frequency converter, and the result is a phase-stabilized 4.43-MHz chrominance signal.

The phase fluctuation of the chrominance signal is almost completely eliminated by the AFC loop alone. In other words, the horizontal synchronizing signal is utilized as a pilot signal. However, because the frequency ratio of the pilot frequency f_H to the 4.43-MHz chrominance frequency is large, the residual phase error is magnified by this same proportion, and the phase error in the 4.43-MHz signal cannot be ignored. For this reason the APC has been added.

The phase of the pilot burst signal within the chrominance signal which was converted to 4.43 MHz and that of the reference 4.43-MHz crystal oscillator output are compared, and the 4.43-MHz variable-frequency crystal oscillator is controlled by this voltage difference. In this way, the phase of the playback chrominance signal is stabilized.

In addition, because the playback chrominance signal is played back at the frequency of $(44 - 1/8)f_H$ for the field A period and at the frequency of $(44 + 1/8)f_H$ for the field B period, it is necessary to return this to the original continuous phase. This is performed by switching the frequency of the frequency conversion carrier signal to 4.43 MHz + $(44 - 1/8)f_H$ for the field A period and 4.43 MHz + (44 + 1/8) for the field B period, the same as for during recording.

Even in the APC system, which utilizes a pilot burst, a phase shift of as much as 180° may occur at the track switching point, due to the movement of the 25 PG pulse which detects the drum rotation during recording, or due to dropout or tape skew.

This results in the hue of the upper part of the picture becoming blurred because the APC circuit of the television set does not respond quickly enough. This is prevented by the pilot burst ID circuit shown in the illustration. Here the phase comparison of the 4.43-MHz crystal oscillator output and the pilot burst signal is done. When the phase of the pilot burst is approximately 180° at the changeover point, this is detected, a trigger pulse is supplied to the flip-flop (FF), the phase switcher is switched, and the phase is returned to approximately 0°.

After the pilot burst has been used in the APC, it is eliminated. In addition, the crosstalk in the playback chrominance signal from the adjacent track is eliminated by a comb filter.

c. Detailed parts description

The chrominance signal processor circuits are on the VD-2 circuit board and are composed of 5 ICs: CX-136A (Q1203), CX-832 (Q1201), CX-150 (Q1204), MB14300 (Q1205), and TC4053 (Q1202).

(1) Recording system chrominance signal processor Q1203 (CX-136A)

Q1203 is the chrominance signal processor IC for both recording and playback, and performs ACC (Automatic Chromalevel Control), frequency conversion, colour killer, etc. The black diagram and peripheral circuitry of Q1203 are shown in Fig. 2-1-23.

The video input signal is applied to the 4.43-MHz frequency range filter where the chrominance signal is separated. The filter output passes through the analog switch (Q1218 and D1204) and is applied to the ACC gain control amplifier from pin (15) of Q1203. The levels for the ACC control range are +10 dB ~ -16 dB (0 dB = 100 mVp-p).

The DC voltage which detects the burst signal in the later stage is applied to the gain control amplifier, and the gain control is performed so that the burst signal level becomes constant. The capacitor of pin (16) is a de-coupling capacitor. The ACC output of pin (12) passes through the pilot burst addition circuit of Q1202 (TC4053) and also through Q1212, and is supplied to the burst gate circuit.

The explanation will begin with the ACC loop: The chrominance signal which passes through the analog switch (Q1212 and D1202) passes through the comb filter which is composed of Q1210, DL1201, Q1209, and Q1208, and is then supplied to the output amplifier of pin (6) of Q1203. The output of the output amplifier enters the burst gate.

The burst is extracted in the burst gate by the burst gate signal which is applied to pin (22). The extracted burst signal is applied from pin (20) to the burst resonance transformer T1203. T1203 functions as a 4.43-MHz narrow frequency range filter, and eliminates all noise other than the burst.

Because the output of the T1203 resonance circuit is too large at this time, it is attenuated by the divider circuit of C1245 and C1246. The attenuated burst signal is supplied to pin (18). The burst signal of pin (18) is amplified by the filter amplifier to a level sufficient enough to drive the detector circuit. The 4.43-MHz burst signal is detected by the detector circuit and the detector output is supplied from pin (19) to the holding circuit which is composed of C1237 and R1246.

Switches 1 and 2 are always switched to the pin (19) side and the pin (10) side, respectively, because control terminal (7) is earthed. In order to hold the burst voltage which appears intermittently, the time constant of C1237 and R1246 is made sufficiently long. The DC voltage held in C1237 and C1238 is superimposed with another burst by T1203. This is detected by Q1222, and then kept smooth by the second time constant of C1248 and R1254. The loop is further stabilized by R1255, C1214, R1220, and C1249, and the signal is supplied to pin (10) and pin (11).

The voltage of pin (10) and pin (11) is amplified by the DC amplifier to control the ACC gain amplifier, and is also supplied to the colour killer circuit. The colour killer functions when the ACC loop is locked out. In order to increase the ACC amplifier gain when the chrominance input is small, the operating DC voltage of pin (10) and pin (11) decreases. If the input becomes smaller than the ACC coverage range, the ACC becomes locked out, and the voltage of pin (10) and pin (11) changes to about 1 V. When the voltage to pin (10) and pin (11) falls below 4 V, the colour killer begins functioning.

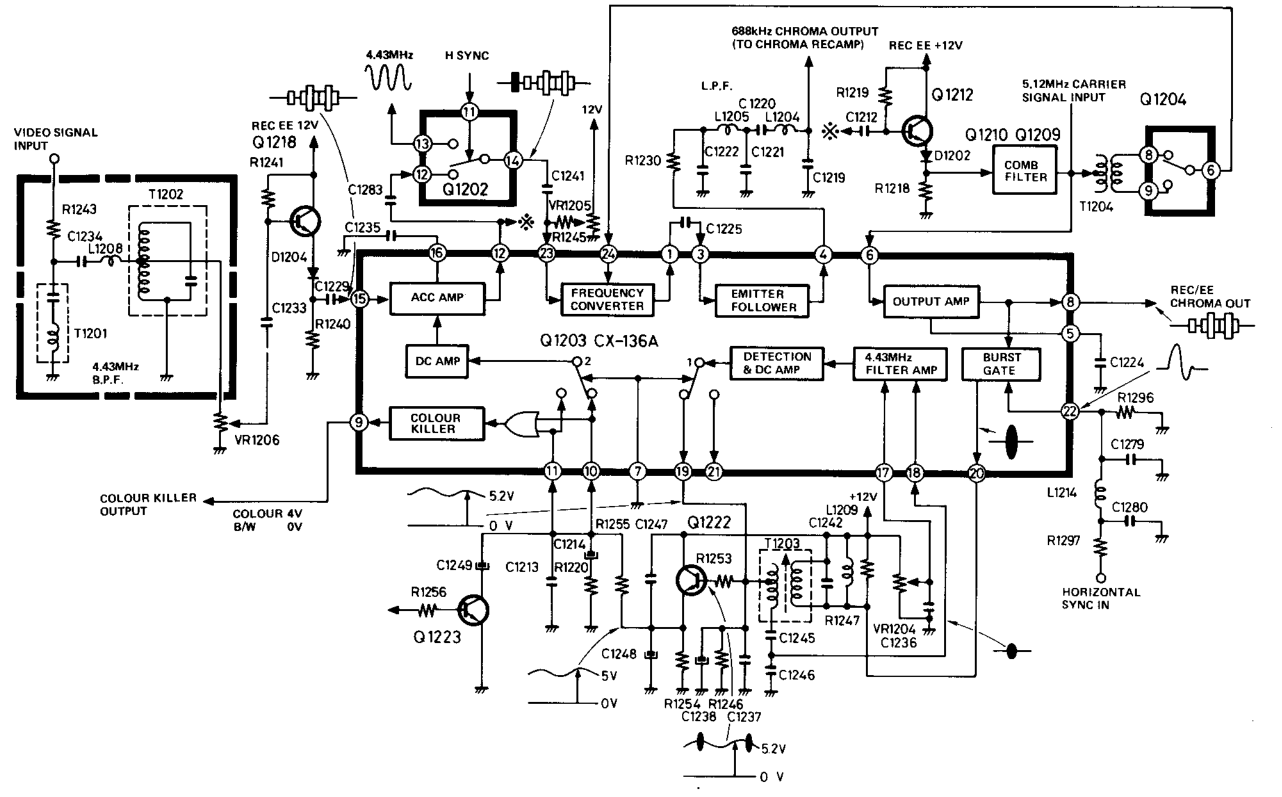

VIDEO SIGNAL INPUT
R1243
C1234
L1208
T1202
T1201
4.43MHz B.P.F.
REC EE 12V
Q1218
R1241
D1204
C1233
C1229
R1240
VR1206
COLOUR KILLER OUTPUT
COLOUR 4V
B/W 0V
4.43MHz
H SYNC
12V
Q1202
C1283
C1235
C1241
VR1205
R1245
ACC AMP
DC AMP
COLOUR KILLER
FREQUENCY CONVERTER
Q1203 CX-136A
688kHz CHROMA OUTPUT (TO CHROMA RECAMP)
REC EE +12V
L.P.F.
C1220
L1205
L1204
C1222
C1221
R1230
R1219
C1212
C1219
Q1212
D1202
R1218
C1225
EMITTER FOLLOWER
DETECTION & DC AMP
4.43MHz FILTER AMP
BURST GATE
OUTPUT AMP
5.12MHz CARRIER SIGNAL INPUT
Q1210 Q1209
COMB FILTER
Q1204
T1204
REC/EE CHROMA OUT
C1224
R1296
C1279
L1214
C1280
R1297
HORIZONTAL SYNC IN
5.2V
0 V
C1249
C1213
C1214
R1220
R1256
Q1223
R1255
C1247
Q1222
R1253
T1203
+12V
L1209
C1242
R1247
VR1204
C1236
C1245
C1246
C1248
5V
0V
R1254
R1246
C1238
C1237
5.2V
0 V

Fig. 2-1-23 Recording chrominance signal processor circuit Q1203 (CX-136A)

The colour killer level during playback is automatically determined by the setting of the VR1204 ACC output level. During recording, the record/playback balance is obtained by the setting of the VR1206 REC ACK level. Also, in order to increase the stability in the area of the colour killer functioning point, a hysteresis characteristic is provided.

The killer function is carried out during the black-and-white mode through the stopping of the function of the chrominance recording amplifier Q1214 by the output of the colour killer. The colour killer output of pin (9) is also used to stop the chrominance input to the Y/C mixer, and for the selection of the colour mode or black-and-white mode of the Y signal system.

Returning to the flow of the recording chrominance signal, after the pilot burst has been added by Q1202, the chrominance signal applied from pin (23) of Q1203 to the frequency converter is converted from 4.43 MHz to 688 kHz.

The frequency converter is composed of a balanced modulator. When the two inputs, fs (4.43 MHz) and fc (5.12 MHz) are applied to the balanced modulator, only the sum component of the two frequencies (approximately 9.55 MHz) and the difference component of the two frequencies (688 kHz) are obtained in the output. Accordingly, if this difference component is separated by a filter, the 4.43 MHz chrominance signal is converted to a low frequency range (fc-fs), 688 kHz. The 5.12-MHz carrier signal passes through the burst ID circuit from Q1201, and is supplied to pin (24).

In this frequency conversion process, the frequency of the chrominance signal is converted to (44 - 1/8)f_H for the field A period and (44 + 1/8)f_H for the field B period. This frequency conversion is done by converting over the frequency of the AFC system.

The frequency converter output enters pin (3) from pin (1), passes through the emitter follower, and is supplied from pin (4) to the low band pass which is composed of L1205, L1204, and C1219 ~ C1222, where the 688-kHz component is separated. After the 688-kHz chrominance signal is amplified by the chrominance amplifier of Q1214, it passes through the Q1213 buffer, and is supplied to the recording amplifier of the VD-1 circuit board.

(2) Playback system chrominance signal processor Q1203

During the PLAY mode, the playback RF signal is supplied by the RF playback amplifier Q1501 located on the VD-1 circuit board. Because the Y-FM signal is contained in this playback RF signal, it passes through a low-pass filter where the FM signal is eliminated and the 688-kHz chrominance signal is extracted.

This filter output passes through the analog switch (Q1217 and D1203), and is applied to pin (15) of Q1203. This IC is the same as that used during recording. Fig. 2-1-24 shows the playback block diagram and the peripheral circuitry.

The 688-kHz chrominance signal is applied to the ACC gain control amplifier from pin (15). The DC voltage which detects the burst signal in the later stage is applied to the gain control amplifier, and gain control is performed so that the burst signal level becomes constant. There is an ACC detection output hold circuit for each channel; therefore, the ACC loop is set up in such a way that even when the level difference between the two channels A and B is great, the difference in the output level is reduced almost to zero.

In addition, because a frequency converter, a comb filter, and an output amplifier are also included within the ACC loop, these deviations do not appear in the output.

The ACC output is applied to the frequency converter, and is converted to a frequency of 4.43 MHz, which is the difference between it and the carrier signal of 5.12 MHz. In frequency conversion during playback, the output frequency and carrier frequency approach one another in value; therefore, if the converter balance is poor, carrier leak will occur. In order to prevent this, balance regulation is carried out by VR1205.

In addition, the playback chrominance signal is $(44 - 1/8)f_H$ for channel A and $(44 + 1/8)f_H$ for channel B, but in this frequency conversion process, the signal is returned to a single frequency and continuous phase. This is accomplished by switching the AFC output frequency by either $(44 - 1/8)f_H$ or $(44 + 1/8)f_H$.

Because the frequency converter creates a difference, the directions of the phase shift of the carrier frequency and of the frequency converter output are always opposite; therefore, the direction of the phase shift of the chrominance signal is automatically reversed for the REC mode and the PLAY mode. Therefore, in the recording/playback process, the chrominance phase shift direction is reversed, and then reversed again, returning the vector to its original direction. (Refer to Fig. 2-1-25.) As a result, the phase of the crosstalk component from the adjacent track (for both A and B channels) is reversed every 2H.

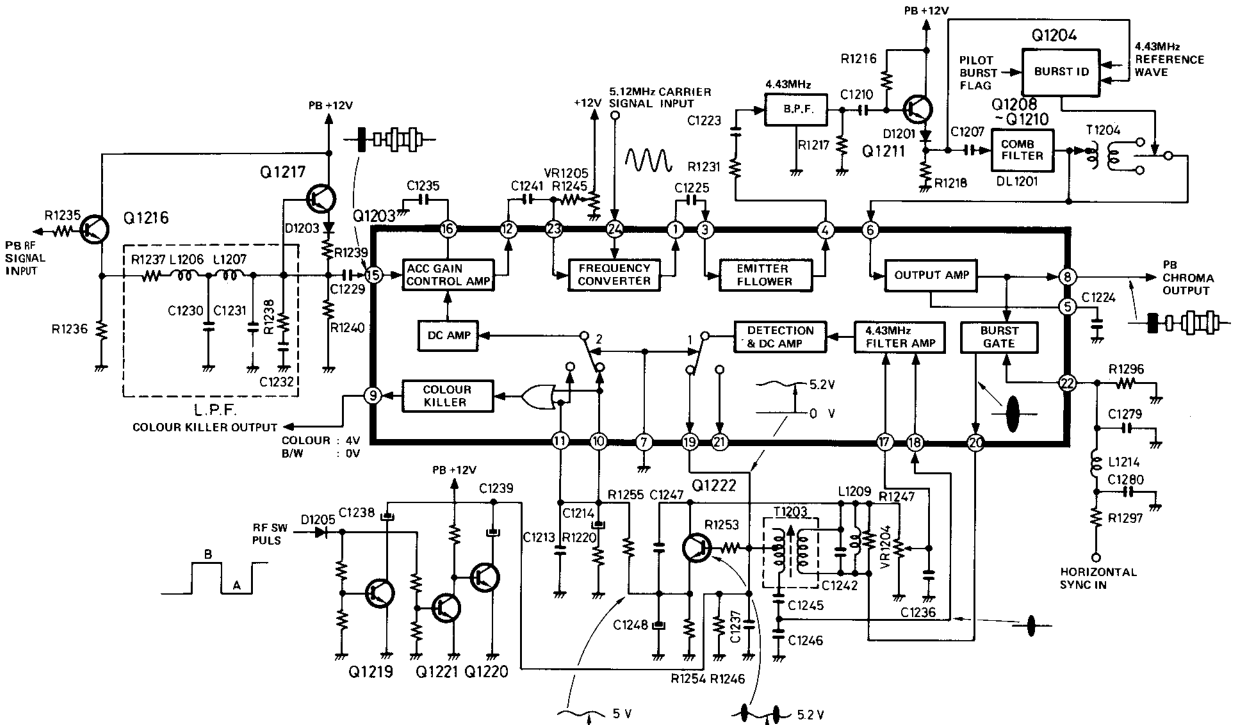

PB +12V
Q1204
4.43MHz REFERENCE WAVE
PILOT BURST FLAG
BURST ID
R1216
4.43MHz
B.P.F.
C1210
Q1208 ~Q1210
5.12MHz CARRIER SIGNAL INPUT
+12V
C1223
D1201
C1207
COMB FILTER
T1204
R1217
Q1211
R1218
DL1201
PB +12V
Q1217
VR1205
C1235
C1241 R1245
R1231
C1225
R1235
Q1216
D1203
Q1203
PB RF SIGNAL INPUT
R1237 L1206 L1207
R1239
C1229
ACC GAIN CONTROL AMP
FREQUENCY CONVERTER
EMITTER FLLOWER
OUTPUT AMP
PB CHROMA OUTPUT
C1224
R1236
C1230 C1231
R1238
R1240
DC AMP
DETECTION & DC AMP
4.43MHz FILTER AMP
BURST GATE
R1296
C1232
COLOUR KILLER
5.2V
0 V
C1279
L.P.F.
COLOUR KILLER OUTPUT
COLOUR : 4V
B/W : 0V
L1214
C1280
R1297
PB +12V
C1239
R1255 C1247
Q1222
L1209 R1247
D1205 C1238
RF SW PULS
B
A
C1214
C1213 R1220
R1253
T1203
VR1204
C1242
C1245
C1236
HORIZONTAL SYNC IN
C1248
C1237
C1246
Q1219 Q1221 Q1220
R1254 R1246
5 V
0 V
5.2 V
0 V

Fig. 2-1-24 Playback chrominance signal processor circuit Q1203 (CX-136A)

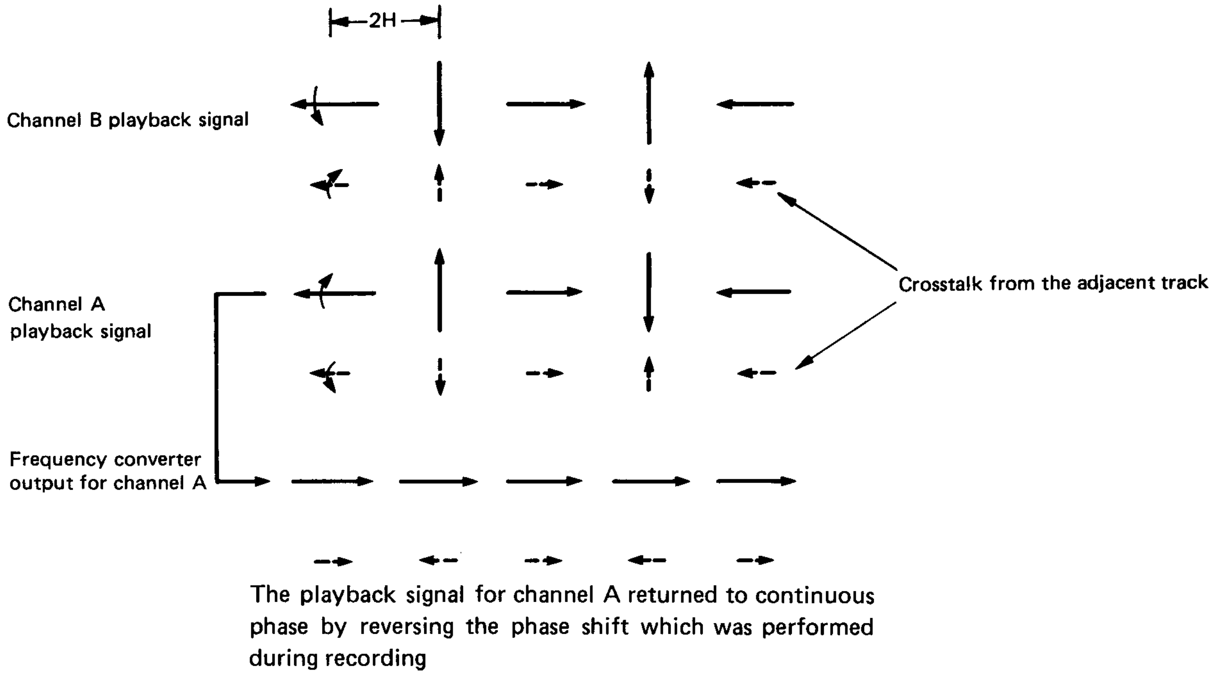

2H
Channel B playback signal
Channel A playback signal
Crosstalk from the adjacent track
Frequency converter output for channel A
The playback signal for channel A returned to continuous phase by reversing the phase shift which was performed during recording

Fig. 2-1-25 Relationship of the playback chrominance signal to the crosstalk signal

The chrominance signal separated by the 4.43-MHz filter passes through the analog switch (Q1211 and D1201), and is applied to the comb filter. This comb filter is composed of a 2H delay line and a resistance mixer circuit. Here the crosstalk is eliminated by making use of the fact that, while the signal component is in continuous phase, the phase of the crosstalk component from the adjacent track shifts 180° every 2H.

In order to simplify the explanation up until now, the chrominance signal has been supposed to in-phase at every 2H and, in relation to this, the phase of the crosstalk component from the adjacent track has been assumed to reverse every 2H.

However, in actuality, because of the 1/4-line offset effect of the PAL system, the phase of the chrominance signal reverses every 2H, and, contrary to what has been said previously, the phase of the chrominance signal reverses every 2H and the crosstalk component remains in-phase.

In the comb filter, the 2H delay line output is subtracted from the signal which does not pass through the delay line.

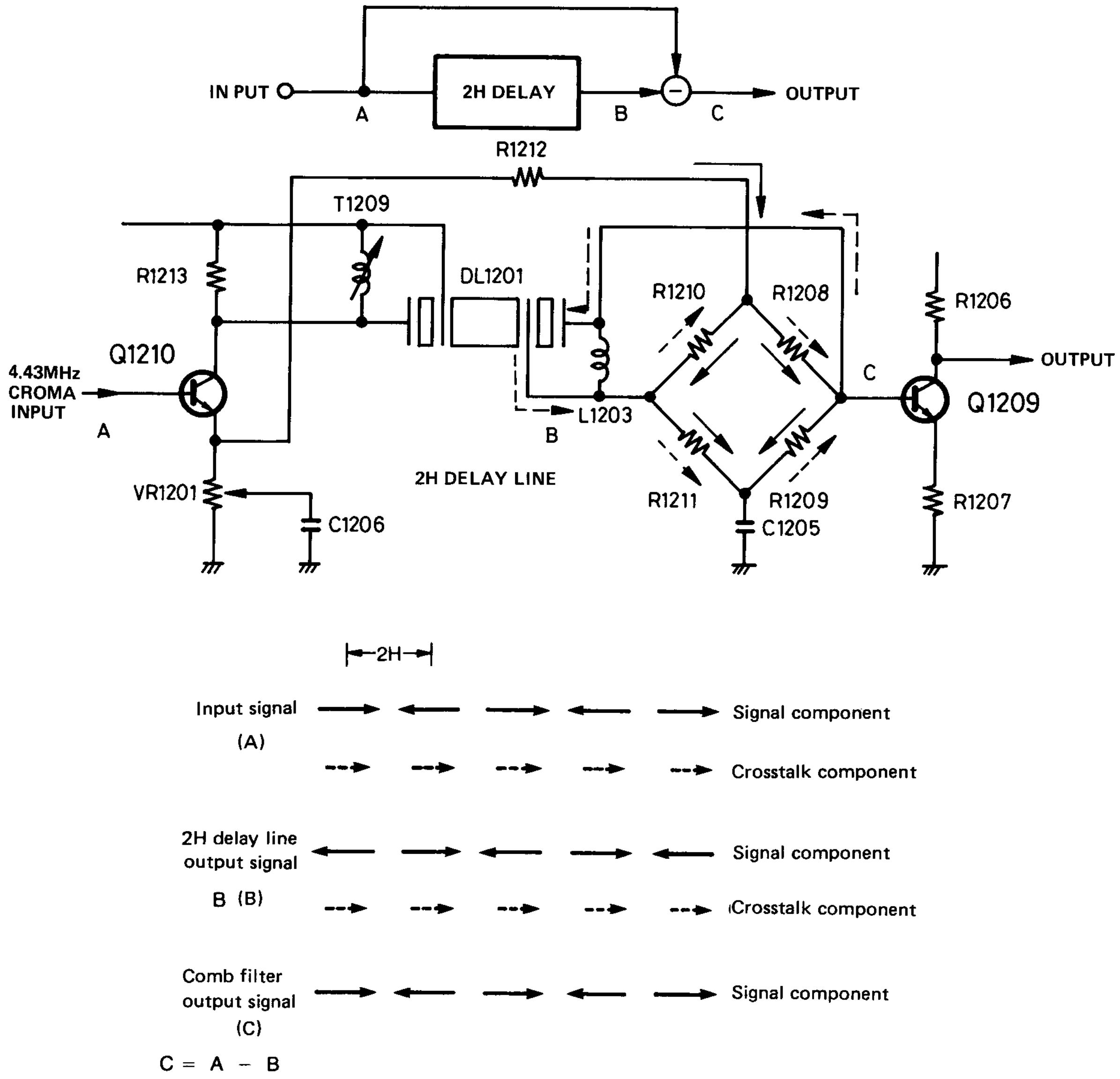
As shown in Fig. 2-1-26, this is accomplished by having the two signals flow through R1209 in opposite directions. Because the crosstalk element is in-phase, it is cancelled by this subtraction, and the resulting output is zero.

In contrast, the result for the chrominance signal, whose phase shifts every 1H, is that it is added here to produce a doubled output. The chrominance signal obtained from the two ends of R1209 is amplified in the chrominance amplifier Q1209, passes through the buffer Q1208, and is supplied to pin (6) of Q1203.

The burst gate uses the burst gate signal applied to pin (22) to extract the burst. From there until the point where the burst controls the ACC gain amplifier, the operation is the same as that during recording, with the following two exceptions: First, there are separate hold capacitors for channel A and channel B, and the switching between them is carried out by Q1219 ~ Q1221.

For this reason, there is an independent ACC loop for each channel, and this means that, even if the channel balance is poor and there is a large difference in the chrominance level of the two channels, there is hardly any difference in the ACC output.

An RF switching pulse passes through D1205 and enters Q1219; for channel B, Q1219 switches ON and C1238 is connected, and, in the same way for channel A, C1239 is connected. Next, C1249, which was connected to pin (10) and pin (11) during recording, is disconnected when Q1223 switches OFF. Because of head contact irregularities, etc., the playback chrominance signal contains, even within the field period, short-cycle fluctuations. Also, during playback variations, the level falls remarkably in the areas of the noise bands. Following this, in order to fix the amplitude, the burst is again superimposed by T1203 on the hold voltage of pin (19), and the peak is detected by Q1222. Accordingly, the time constant for points after Q1222 is, during playback, made shorter by Q1223.


IN PUT
A
2H DELAY
B
C
OUTPUT
R1212
T1209
R1213
DL1201
R1210
R1208
R1206
Q1210
4.43MHz
CROMA
INPUT
A
L1203
B
C
OUTPUT
Q1209
2H DELAY LINE
R1211
R1209
C1205
R1207
VR1201
C1206
2H
Input signal
(A)
Signal component
Crosstalk component
2H delay line
output signal
B (B)
Signal component
Crosstalk component
Comb filter
output signal
(C)
Signal component
C = A − B

Comb filter passing characteristic

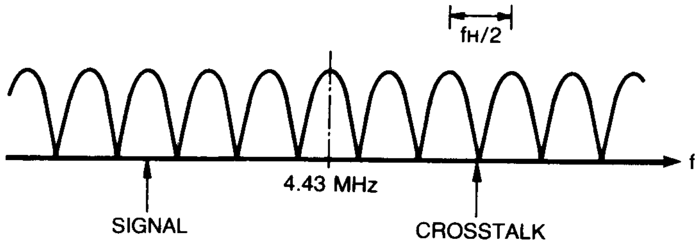


Fig. 2-1-26 Comb filter operation

(3) AFC circuit and APC circuit

Q1201 (CX-832) is the AFC and APC system IC, and is composed of the AFC circuit, the APC circuit, the 4.43-MHz reference oscillator, the 4.43-MHz VXO, and the frequency converter.

(a) AFC circuit

The 688-kHz continuous wave signal which multiplies the horizontal synchronizing signal by (44 ± 1/8) is obtained in the AFC circuit during both recording and playback. A PLL (Phase-Locked Loop) is employed to perform the

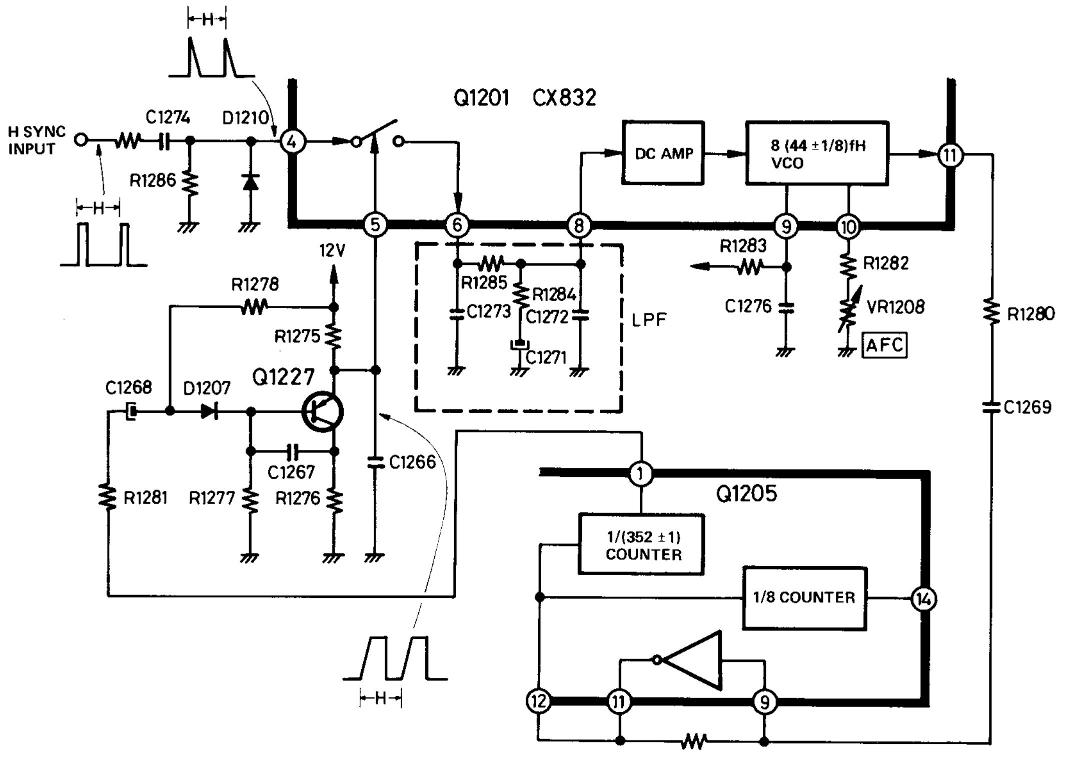

H
H SYNC INPUT
C1274
D1210
R1286
H
Q1201 CX832
DC AMP
8 (44 ±1/8)fH VCO
4
5
6
8
9
10
11
12V
R1278
R1275
Q1227
C1268
D1207
C1267
C1266
R1281
R1277
R1276
R1285
R1284
C1273
C1272
C1271
LPF
R1283
C1276
R1282
VR1208
AFC
R1280
C1269
1
Q1205
1/(352 ±1) COUNTER
1/8 COUNTER
14
12
11
9
H

Fig. 2-1-27 AFC circuit

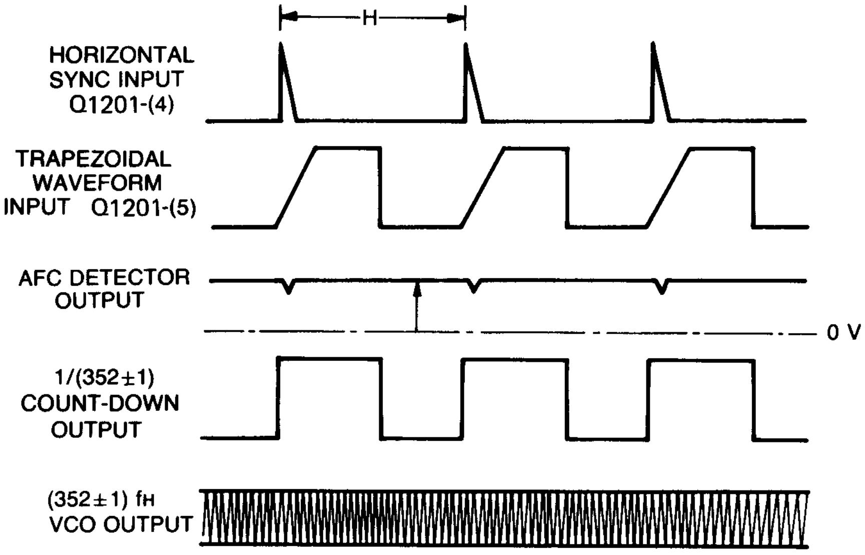

H
HORIZONTAL SYNC INPUT Q1201-(4)
TRAPEZOIDAL WAVEFORM INPUT Q1201-(5)
AFC DETECTOR OUTPUT
0 V
1/(352±1) COUNT-DOWN OUTPUT
(352±1) fH VCO OUTPUT

Fig. 2-1-28 AFC circuit waveforms

multiplication by (44 ± 1/8); however, because of the use of the horizontal synchronizing signal, it is called AFC in reference to television receivers. In order to obtain the (44 ± 1/8)f_H frequency, it is actually necessary to count down 8(44 ± 1/8)f_H frequency to f_H and phase-compare it to the input f_H. The AFC circuit is shown in Fig. 2-1-27. The 1/352±1 countdown circuit, which is a part of the AFC loop, uses Q1205 (MB14300).

The AFC detection circuit is a sampling hold circuit and phase detection is accomplished by using the horizontal synchronizing pulse applied to pin (4) of Q1201 to sample the trapezoidal wave applied to pin (5). The various waveforms are shown in Fig. 2-1-28. The detection output passes through the low-pass filter (C1273, C1272, C1271, R1285, and R1284) from pin (6), and then is applied to the DC amplifier of pin (8).

The DC amplifier output controls the 8(44 ± 1/8)f_H VCO oscillation frequency, and an oscillation output of 8(44 ± 1/8)f_H is obtained. The oscillation circuit is a multivibrator oscillator composed of capacitors and resistors, and the oscillation frequency is determined by R1283 and C1270 of pin (9). The current during multi-vibrator discharge is varied by VR1208 in order to regulate the oscillation frequency.

The oscillation output enters pin (12) of Q1205, and is supplied to the 1/(352 ± 1) counter and to the 1/8 counter. The 1/8 counter output becomes a frequency of (44 ± 1/8)f_H and is supplied to the frequency converter of pin (14) of Q1201.

Because the countdown output is a square wave, it is shaped into a trapezoidal wave before being supplied to the AFC detection circuit of Q1201.

Through the use of the AFC loop described above, it is possible to achieve an 8(44 ± 1/8)f_H VCO output synchronized with the horizontal synchronizing frequency. The VCO output is counted down by 1/8 to (44 ± 1/8)f_H, converted to a frequency of 5.12 MHz (the sum of itself and the 4.43-MHz crystal oscillator output) by the frequency converter, and then supplied to the chrominance signal frequency conversion circuit.

(b) APC circuit

The APC circuit is shown in Fig. 2-1-29. The APC circuit comprises a phase detector circuit, a reactance circuit, a 4.43-MHz crystal oscillator circuit, and a 4.43-MHz crystal oscillator circuit which consists of a phase reference and a burst gate circuit for phase detecting only the burst signal. The reactance circuit is a capacitance variable type. It is connected to the 4.43-MHz crystal oscillator circuit, and is a part of the oscillation constant. By connecting the phase detector to the reactance circuit, the reactance circuit and the 4.43-MHz crystal oscillator become the 4.43-MHz VXO (variable frequency crystal oscillator, hereafter referred to as the VXO) controlled by the phase detector output.

The sum of the output of this VXO and the 688-kHz [(44 ± 1/8)f_H] output is obtained by the frequency converter, and converted to a frequency of 5.12 MHz, or in other

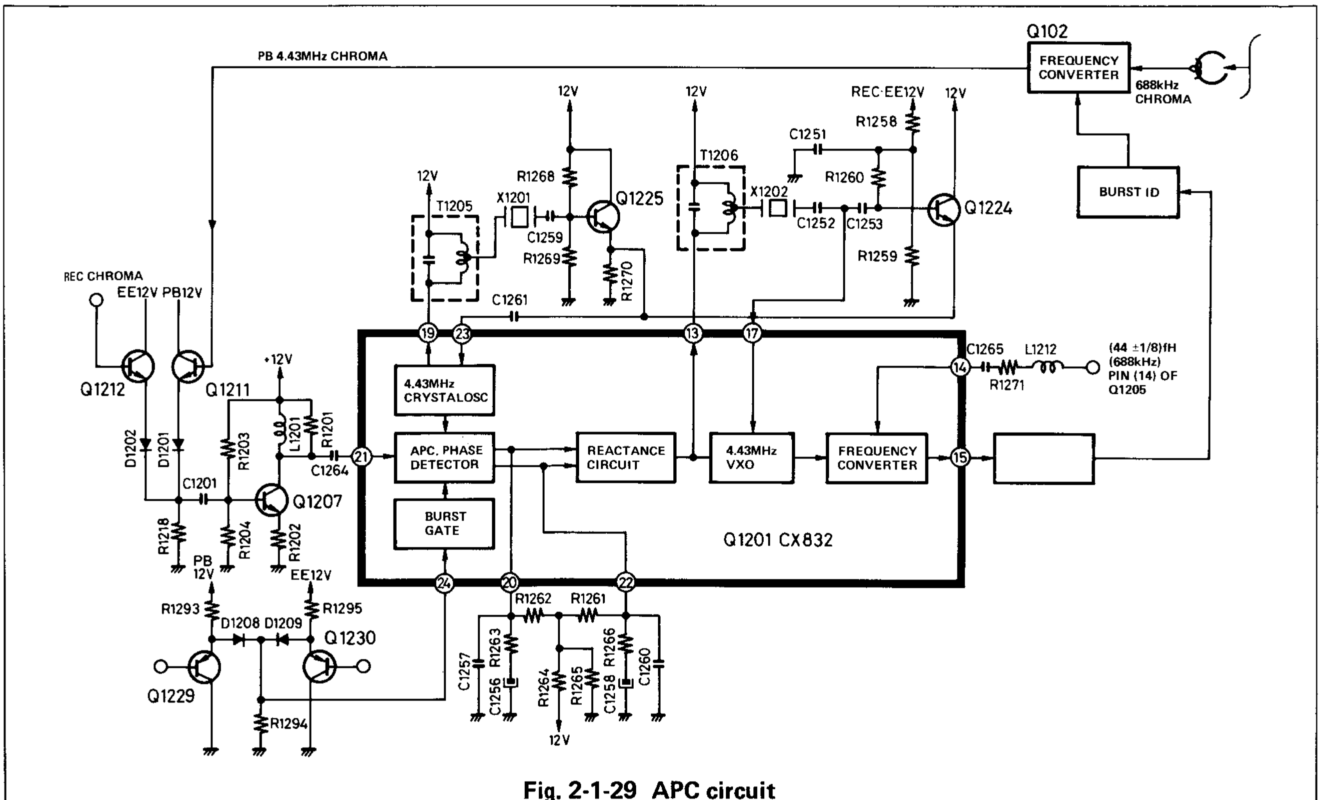

Q102
FREQUENCY CONVERTER
688kHz CHROMA
PB 4.43MHz CHROMA
BURST ID
12V
12V
REC·EE12V
12V
R1258
C1251
T1206
X1202
R1260
C1252
C1253
Q1224
R1259
12V
R1268
X1201
Q1225
T1205
C1259
R1269
R1270
C1261
REC CHROMA
EE12V
PB12V
Q1212
Q1211
+12V
D1202
D1201
R1203
L1201
R1201
C1264
C1201
Q1207
R1218
R1204
R1202
PB 12V
EE12V
R1293
R1295
D1208
D1209
Q1230
Q1229
R1294
19
23
13
17
14
21
15
24
20
22
4.43MHz CRYSTALOSC
APC. PHASE DETECTOR
BURST GATE
REACTANCE CIRCUIT
4.43MHz VXO
FREQUENCY CONVERTER
Q1201 CX832
C1265
L1212
R1271
(44 ±1/8)fH (688kHz) PIN (14) OF Q1205
R1262
R1261
C1257
R1263
C1256
R1264
R1265
R1266
C1258
C1260
12V

Fig. 2-1-29 APC circuit

words, 4.43 MHz + (44 ± 1/8)f_H. This output (5.12 MHz) passes through the band filter from pin (15) of Q1201, and is then supplied to the chrominance frequency converter for both recording and playback. In the APC phase detector circuit, the recording 4.43-MHz chrominance signal passes through Q1212 and D1202 during recording, and the playback 4.43-MHz chrominance signal passes through Q1211 and D1202 during playback and both are supplied from pin (21).

The other signal that enters the APC phase detector circuit enters pin (23) and is supplied as the output of X1202 (VXO) during recording when Q1224 switches ON, or as the output of X1201 (the reference oscillator) during playback if Q1225 switches ON. This is summarized in Table 1.

Mode Phase comparison input	Record	Playback
Pin (21) Pin (23)	Recording chrominance signal (4.43 MHz) VXO output	Playback chrominance signal (4.43 MHz) Reference oscillator
Pin (24)	Burst flag	Pilot burst flag

Table 1

The phases of the pilot burst (intrinsic burst during recording) of the chrominance signal and the 4.43-MHz reference (VXO output during recording) are compared. The detector output is smoothed by the capacitor and resistor filters of pin (20) and pin (22), supplied to the VXO, and the 4.43-MHz frequency of X1202 is controlled.

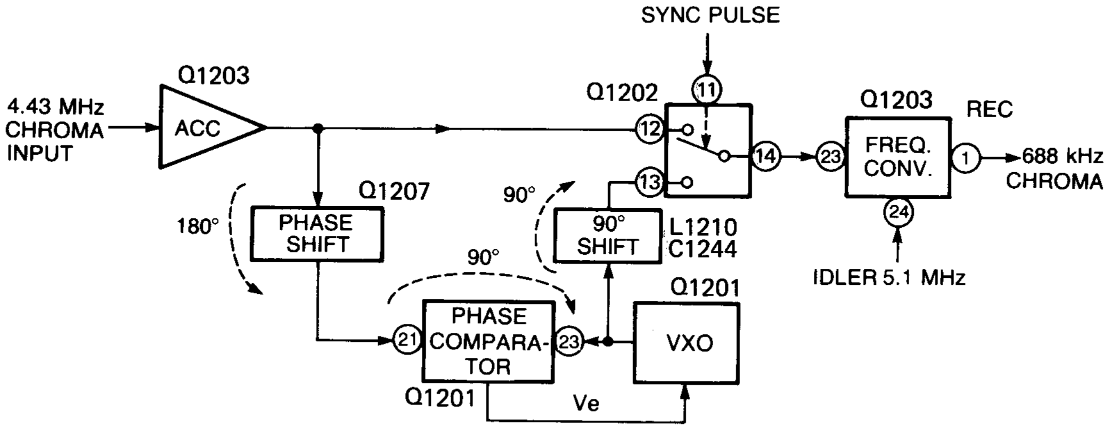


Fig. 2-1-30 Recording of the false burst

Because phase comparison is carried out by the pilot burst signal (the burst signal during recording), the function of the phase detector circuit is controlled by the burst gate circuit so that the APC phase detector output will gain only during the burst interval.

As for the burst gate pulse of pin (24), during recording, a burst flag (intrinsic) is supplied when Q1230 switches ON, and, during playback, a pilot burst flag (horizontal synchronizing signal part) is supplied when Q1229 switches ON.

In the NTSC format, f_{LA} and f_{LB} are defined by their respective absolute frequencies and allowable differences; however, in the PAL format, APC is performed during record because f_L is defined as a N-multiple of the various f_H. The burst for the APC is the frequency of the input subcarrier wave, and the phase is added at -180° ± 10° with respect to the phase of the V axis of the input subcarrier frequency. The composition of the APC during recording and the phase of the pilot (false) burst are shown in Fig. 2-1-30 and Fig. 2-1-31.

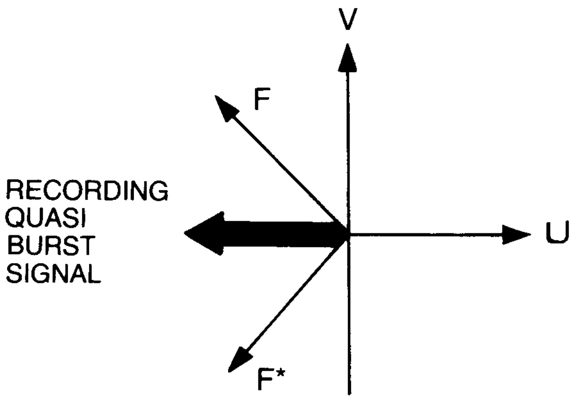


Fig. 2-1-31 Phase of the false burst

During recording, this pilot burst is utilized to apply the APC.

The 688-kHz chrominance signal played back by the video head possesses a (44 ± 1/8)f_H frequency relationship, and this signal includes phase fluctuations due to mechanism vibration, etc. This is first canceled by the phase fluctuation component included in the (44 ± 1/8)f_H PLL output of the AFC circuit. The remaining phase difference is detected by the APC circuit, and, by controlling the 4.43-MHz VXO, the phase fluctuation is eliminated, and a phase-stabilized 4.43-MHz chrominance signal is obtained.

The horizontal pulse of the output of pin (7) of Q1205 forms the pilot burst flag by using Q1228, Q1229, and the AFC circuit of Q1201, and is then supplied to Q1204, Q1202, and Q1201. The horizontal pulse is differentiated by pin (4) of Q1201, and then a pulse whose negative side pulse has been cut by D1210 is supplied, and becomes the sampling gate signal of the AFC detection circuit. In addition, the horizontal pulse also becomes the comparison input of the audio muting circuit.

(4) Pilot burst ID circuit (APC checker)

Q1204 and CX-150 compose the pilot burst ID circuit. The block diagram for CX-150 is shown in Fig. 2-1-32. In the PAL format, because the recording frequency of the chrominance signal changes for each track, the inrushing phase immediately after track switching depends upon the initial phase after AFC switching, and is generally indefinite. Therefore, a certain amount of time is required for the APC followthrough.

Because of this, the APC of the television set does not followthrough, and the hue at the top of the picture becomes blurred. The pilot burst ID circuit is used to prevent this. (Refer to Fig. 2-1-33.) In other words, the pilot burst and the phase of the 4.43-MHz reference oscillator are compared, and, if the result is within the oblique line in Fig. 2-1-34, the chrominance phase is instantaneously reversed by the phase switch. As shown in Fig. 2-1-33, the burst ID loop is outside the APC loop, and does not influence it. In other words, the ID loop is for speeding up the lead-in of the APC of the television set. Also, because the ID loop is small, switching is rapid, and there is no transit error.

The 5.12-MHz carrier signal from pin (15) of Q1201 is phase-divided by the phase divider transformer T1204. The secondary phase divider output of T1204 is supplied to the switching circuit of pin (8) and pin (9) of Q1204. A regular phase 5.12-MHz carrier signal is applied to pin (8) and a reverse phase 5.12-MHz carrier signal is applied to pin (9). The operation of this switch is carried out by the output obtained from passing the flip-flop output and the input of pin (10) through the OR gate. During recording, a DC voltage is applied to pin (10), the switch is set to the pin (8) side, and the ID operation is stopped. The 5.12-MHz carrier signal from pin (6) is supplied to pin (24) of Q1203.

The playback 4.43-MHz chrominance signal is applied from Q1207 to pin (2) of Q1204, and becomes the phase comparison input. Here the phase of the 4.43-MHz crystal oscillator output [pin (11)] which is the reference signal of the PLAY mode and that of the pilot burst of the chrominance signal of pin (2) are compared, and when the phase is reversed 180°, a trigger pulse is obtained, passed through the OR circuit, and then applied to the

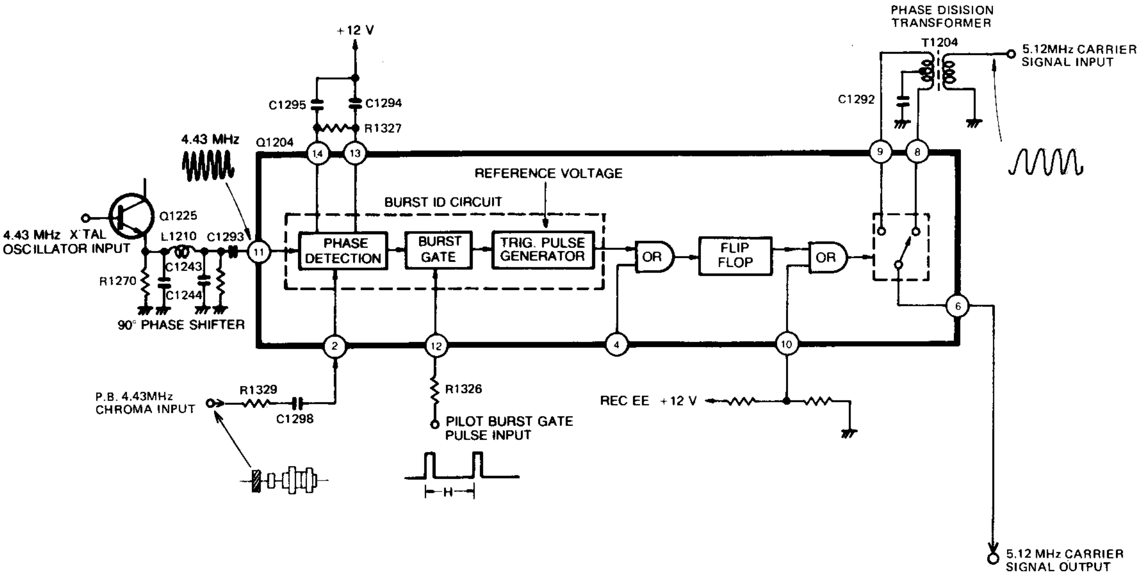

PHASE DISISION
TRANSFORMER
T1204
5.12MHz CARRIER SIGNAL INPUT
+12 V
C1295
C1294
R1327
C1292
4.43 MHz
Q1204
14
13
9
8
REFERENCE VOLTAGE
BURST ID CIRCUIT
Q1225
4.43 MHz X'TAL OSCILLATOR INPUT
L1210
C1293
C1243
C1244
R1270
11
PHASE DETECTION
BURST GATE
TRIG. PULSE GENERATOR
OR
FLIP FLOP
OR
6
90° PHASE SHIFTER
2
12
4
10
P.B. 4.43MHz CHROMA INPUT
R1329
C1298
R1326
PILOT BURST GATE PULSE INPUT
H
REC EE +12 V
5.12 MHz CARRIER SIGNAL OUTPUT

Fig. 2-1-32 Pilot burst ID circuit

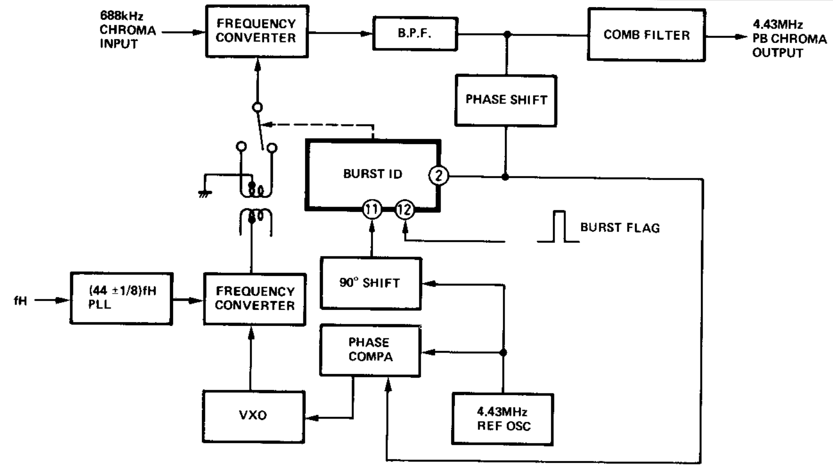


Fig. 2-1-33 Pilot burst ID (during playback)

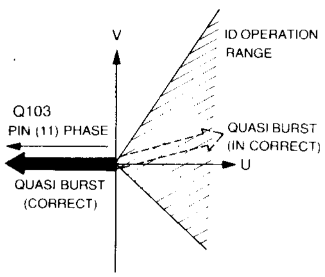


Fig. 2-1-34 Operating area of the burst ID

flip-flop. Generally, while the APC is in the locked position, the relative phase difference between the pilot burst signal of the 4.43-MHz chrominance signal and the reference 4.43-MHz crystal oscillator output is 90°. Next, the reference 4.43 MHz is passed through a 90° phase-shift circuit, and made in-phase with a normal pilot burst, and then phase comparison is carried out. The capacitors and resistors located between pin (13) and pin (14) of the phase detector circuit are the filter for the detector output. The detector output smoothed here is applied to the burst gate. The burst gate operation is carried out by gating the pilot burst period of the phase detector output. The internal reference voltage and the detector output are compared in the trigger pulse generating circuit, and, when the phase of the pilot burst is approximately at 180°, the detector output voltage difference is detected, and a trigger pulse is formed.

(5) 50-Hz reference signal output circuit

At VD-2, this circuit generates the 50-Hz reference signal used in the servo circuit. During the REC mode, the vertical sync is extracted through performing sync separation by Q1238 and Q1239 on the video signal from pin (20) of Q1001 on VD-1. This vertical sync is then sent to the servo circuit.

During the PLAY mode, the 4.43-MHz reference oscillation frequency output is divided by Q1206 (M58478P), a 50-Hz signal is extracted, and this signal is sent to the servo circuit.

(6) Power supply circuit for the various modes

The various power supplies of REC + PAUSE + 12 V, PB + 12 V, and REC EE + 12 V are produced by the VD-1 circuit board. REC + PAUSE + 12 V is produced by Q1040 and Q1039, and PB + 12 V and REC EE + 12 V are both produced by Q1041 and RY1001.

During the EE mode, pin (2) of S1002 becomes HIGH, Q1041 switches ON, RY1001 moves to the NO side, and REC EE + 12 V is output.

During recording, REC EE + 12 V is output the same as for the EE mode. Also, because pin (3) of S1002 becomes HIGH, Q1040 switches ON, and REC + PAUSE + 12 V is output from the collector of Q1039.

During the PLAY mode, pin (2) of S1002 becomes LOW, Q1041 switches OFF, RY1001 moves to the NC side, and PB + 12 V is output.

(7) Audio muting circuit

Q1237 and Q1236 are the gate circuit for the corresponding horizontal pulses and the pulse of the horizontal frequency obtained from the AFC circuit. This gate circuit compares the two pulses, and detects whether the pulses are aligned. After this, the pulses are resonated to 15625 Hz by the resonance circuit of L1210 and C1305, the noise is eliminated, the pulses are rectified by D1213, D1212, and C1303, and the voltage needed to switch Q1235 ON is extracted.

Consequently, when a video signal is input, Q1235 switches ON, and pin (3) of S1201 becomes LOW; when a video signal is not input, pin (3) of S1201 becomes HIGH. This signal causes the audio muting circuit of the tuner to function.

In addition, the switching of the time constant of the AGC circuit of VD-1 is carried out by this signal.

III. SERVO CIRCUIT

1. Producing the PG Pulse

In order to detect the revolution speed and the revolution position of the video head, a PG coil and a magnet are utilized. The relative positions of these are shown in Fig. 2-2-1.

When the video head disc revolves and the video head reaches the position 8° in front of the switching position, a PG-A pulse and a PG-B pulse are generated. The PG-A pulse and PG-B pulse are applied to pin (1) of Q4001. A block diagram of the servo circuit is shown in Fig. 2-2-2.

2. Producing the Video Head Switching Pulse from the PG Pulse

After the PG pulse has been amplified by the PG-A and PG-B wave detectors, the resulting signals are converted to a 25-Hz square wave by FF1. This square wave is supplied to switching position delay B, and is also sent to speed MM1 of the speed control circuitry, and gate pulse 2. In switching position delay B and switching position delay A, the square wave is delayed by approximately 0.89 milliseconds (equivalent to the 8° between the position of the PG coil and the position of the magnet), and any mechanical errors, such as the mounting position of the PG coil, etc., are corrected. For the period that the video head switching pulse (RF switching pulse) which is input to pin (4) of Q4001 is HIGH, head B operates, and for the period that this pulse is LOW, head A operates.

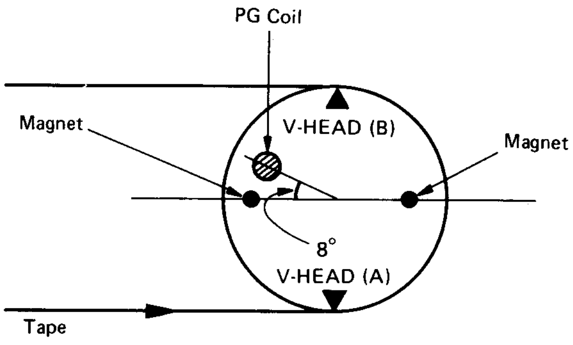

PG Coil
Magnet
V-HEAD (B)
Magnet
8°
V-HEAD (A)
Tape

Fig. 2-2-1 Position of the video heads

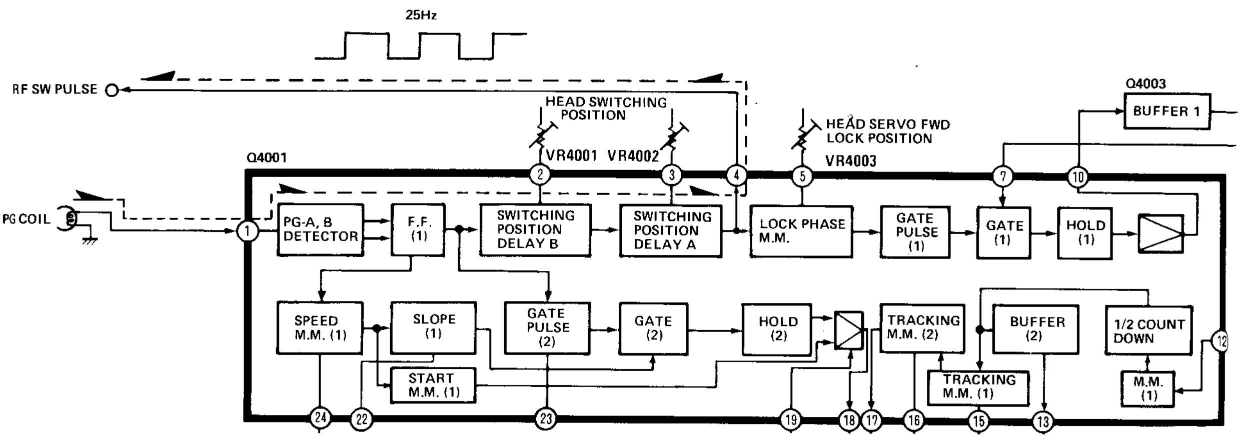

25Hz
RF SW PULSE
HEAD SWITCHING POSITION
VR4001
VR4002
HEAD SERVO FWD LOCK POSITION
VR4003
Q4003
BUFFER 1
Q4001
PG COIL
PG-A, B DETECTOR
F.F. (1)
SWITCHING POSITION DELAY B
SWITCHING POSITION DELAY A
LOCK PHASE M.M.
GATE PULSE (1)
GATE (1)
HOLD (1)
SPEED M.M. (1)
SLOPE (1)
START M.M. (1)
GATE PULSE (2)
GATE (2)
HOLD (2)
TRACKING M.M. (2)
BUFFER (2)
1/2 COUNT DOWN
TRACKING M.M. (1)
M.M. (1)
1
2
3
4
5
7
10
12
13
15
16
17
18
19
22
23
24

Fig. 2-2-2. Servo circuit block diagram

3. Controlling the Speed of the Drum Motor

When a phase servo is used for a DC motor, a circuit that will increase the rpm of the motor up to the level of rpm applied to the phase servo is necessary. The speed control circuit performs this function for the drum motor. The PG pulse is delayed by speed MM1, and a trapezoidal wave is produced by slope 1 [pin (22) of Q4001]. The gate pulse for the PG-B pulse is produced by FF1 and gate pulse 2 [pin (23) of Q4001]. The gate pulse and the trapezoidal wave are passed through gate 2, this gated voltage is held at hold 2, and, after current amplification, is sent from pin (18) of Q4001 to the drum motor drive circuit. Starter 1 operates when the rpm of the motor is low (less than approximately 750 rpm) to forcefully drive the motor, so that the servo is quickly applied.

Starter 1 is an integrating circuit whose time constant is composed of the externally mounted capacitor and resistor. Integration begins when the PG-A pulse is generated, and is reset by the generation of the PG-B pulse. During constant rotation (1500 rpm), resetting is activated before the charging voltage of the capacitor reaches the threshold voltage (6 V), and the start pulse is not output. When the motor begins to rotate, or when its rpm is low, the integration time is long. Charging is then continued past the threshold voltage, and the start voltage is generated.

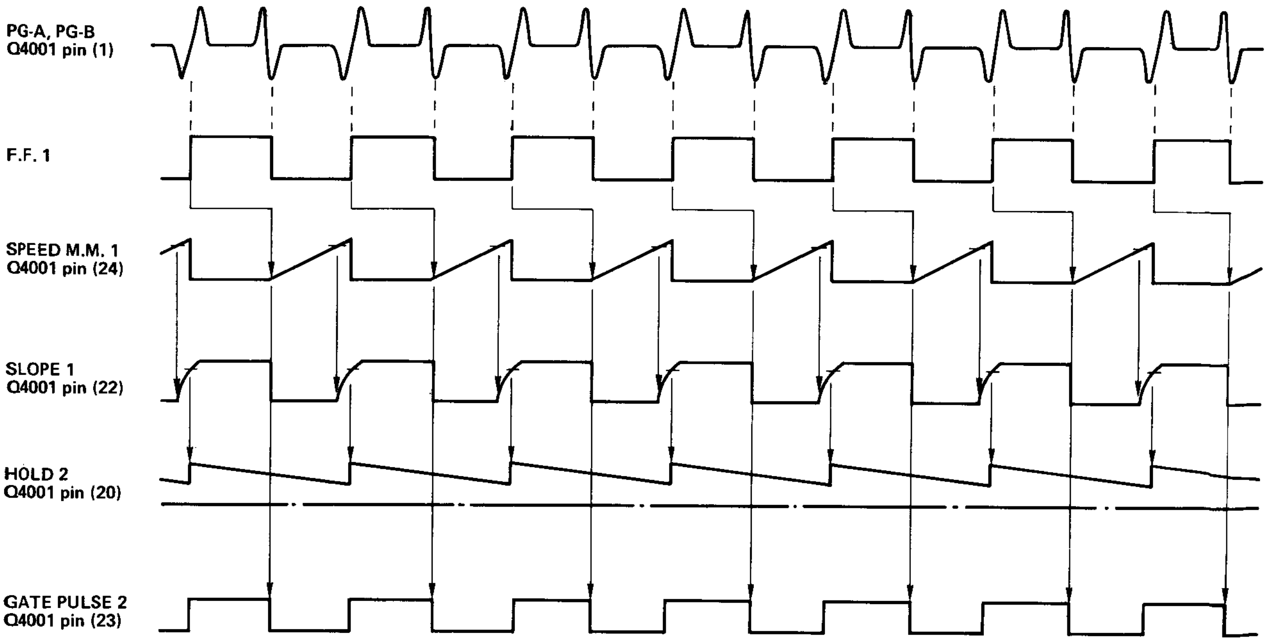


Fig. 2-2-3 Drum motor speed control timing chart

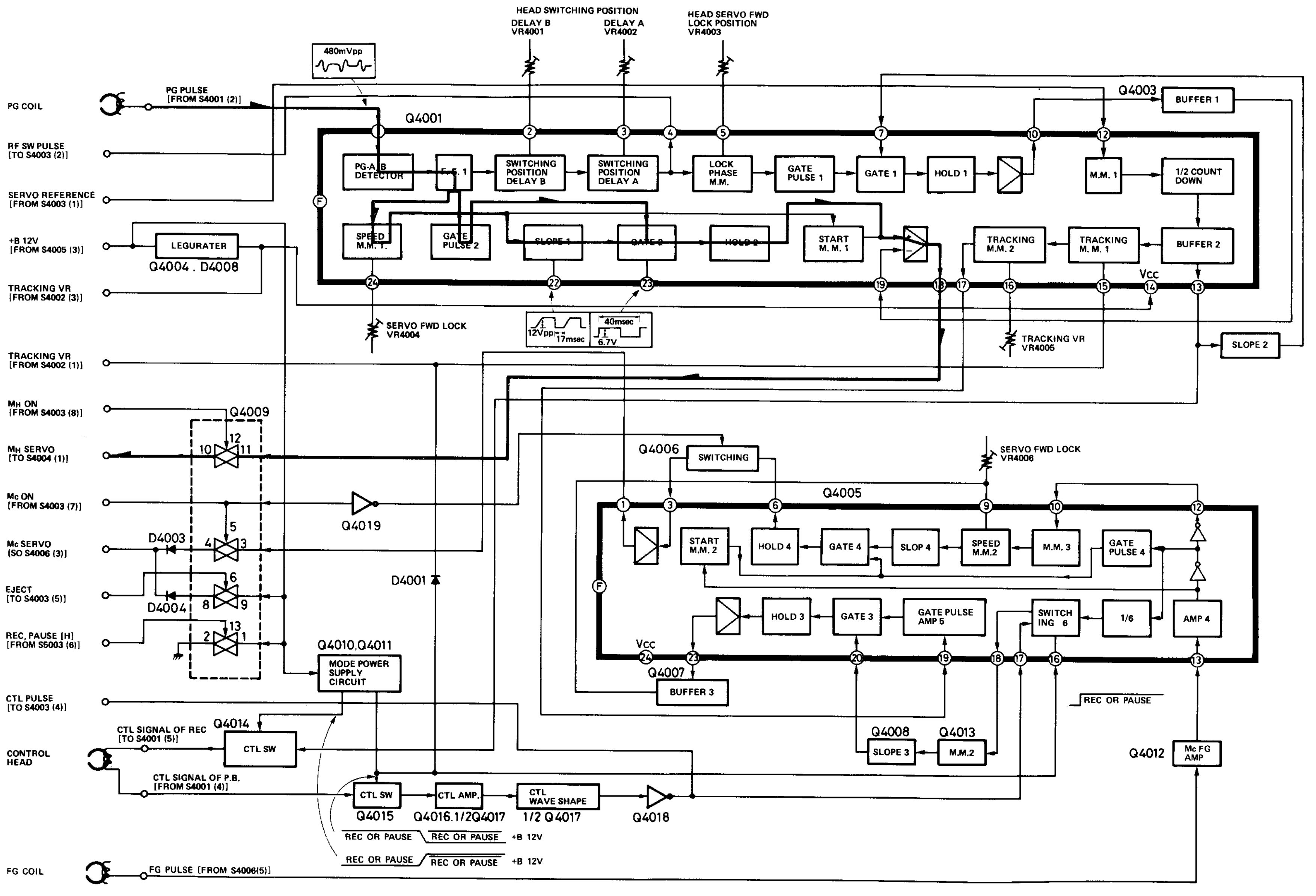

HEAD SWITCHING POSITION
DELAY B VR4001
DELAY A VR4002
HEAD SERVO FWD LOCK POSITION VR4003
480mVpp
PG COIL
PG PULSE [FROM S4001 (2)]
RF SW PULSE [TO S4003 (2)]
SERVO REFERENCE [FROM S4003 (1)]
+B 12V [FROM S4005 (3)]
TRACKING VR [FROM S4002 (3)]
TRACKING VR [FROM S4002 (1)]
MH ON [FROM S4003 (8)]
MH SERVO [TO S4004 (1)]
Mc ON [FROM S4003 (7)]
Mc SERVO (SO S4006 (3)]
EJECT [TO S4003 (5)]
REC, PAUSE [H] [FROM S5003 (6)]
CTL PULSE [TO S4003 (4)]
CONTROL HEAD
FG COIL
Q4001
PG-A/B DETECTOR
F.F. 1
SWITCHING POSITION DELAY B
SWITCHING POSITION DELAY A
LOCK PHASE M.M.
GATE PULSE 1
GATE 1
HOLD 1
Q4003
BUFFER 1
M.M. 1
1/2 COUNT DOWN
SPEED M.M. 1
GATE PULSE 2
SLOPE 1
GATE 2
HOLD 2
START M. M. 1
TRACKING M.M. 2
TRACKING M. M. 1
BUFFER 2
Vcc
F
LEGURATER
Q4004 . D4008
SERVO FWD LOCK VR4004
12Vpp
17msec
40msec
6.7V
TRACKING VR VR4005
SLOPE 2
Q4009
D4003
D4004
Q4019
D4001
Q4006
SWITCHING
SERVO FWD LOCK VR4006
Q4005
START M.M. 2
HOLD 4
GATE 4
SLOP 4
SPEED M.M.2
M.M. 3
GATE PULSE 4
HOLD 3
GATE 3
GATE PULSE AMP 5
SWITCH ING 6
1/6
AMP 4
Q4007
BUFFER 3
Q4008
SLOPE 3
Q4013
M.M.2
REC OR PAUSE
Q4012
Mc FG AMP
Q4010,Q4011
MODE POWER SUPPLY CIRCUIT
Q4014
CTL SIGNAL OF REC [TO S4001 (5)]
CTL SW
CTL SIGNAL OF P.B. [FROM S4001 (4)]
CTL SW
CTL AMP.
CTL WAVE SHAPE
Q4015
Q4016.1/2Q4017
1/2 Q4017
Q4018
REC OR PAUSE
REC OR PAUSE
+B 12V
REC OR PAUSE
REC OR PAUSE
+B 12V
FG PULSE [FROM S4006(5)]

Fig. 2-2-4 Servo circuit block diagram (Drum Motor speed control)

4. Control of the Drum Motor Phase

During recording, the revolution phase of the video head must be synchronized with the video signal (i.e., the position at which the video head begins to trace the cassette tape must be 7H before the front edge of the vertical synchronizing signal of the video signal); furthermore, during playback, the pattern recorded on the tape must be accurately traced by the same head as the recording head. The time that head A begins recording becomes a control signal and is recorded onto the lower edge of the tape by the control head, and, during playback, the recorded control signal is played back. In order that the tracing function of head A begins at this playback time, phase control is applied to the drum motor. Actually, a capstan servo system is employed, the video head rotates in synchronization with the reference signal which is formed by the crystal and the frequency divider circuit. The playback control signal is supplied to the capstan servo circuit, and the tape speed is controlled so that there is a fixed relationship between the reference signal and the phase. Therefore, the reference signal acts as an intermediary, and thus the rotation phase of the video head is synchronized with the playback control signal.

The vertical synchronizing signal of the video signal during recording, and the signal which is formed by the crystal during playback (both of these signals are formed by the VD-2 circuit board), are both applied to pin (12) of Q4001. In addition, after this signal is made highly noise-resistant by MM1, it is formed into a square wave of 25 Hz by the 1/2 countdown.

The signal which indicates the rotation phase of the video head is the trailing edge of the video head switching pulse (PG-A); this signal is delayed by the lock phase MM, passes through gate pulse 1, becomes the gate signal, and is sent to gate 1.

The reference signal of 25 Hz is output from pin (13) of Q4001, becomes a trapezoidal wave at slope 2, and is then sent to pin (7) of gate 1. After the gated voltage is held at hold 1 and current amplified, it is output from pin (10) of Q4001, passes through buffer 1 (Q4003), compared to the speed control voltage, added, and then supplied to the head motor drive circuit.

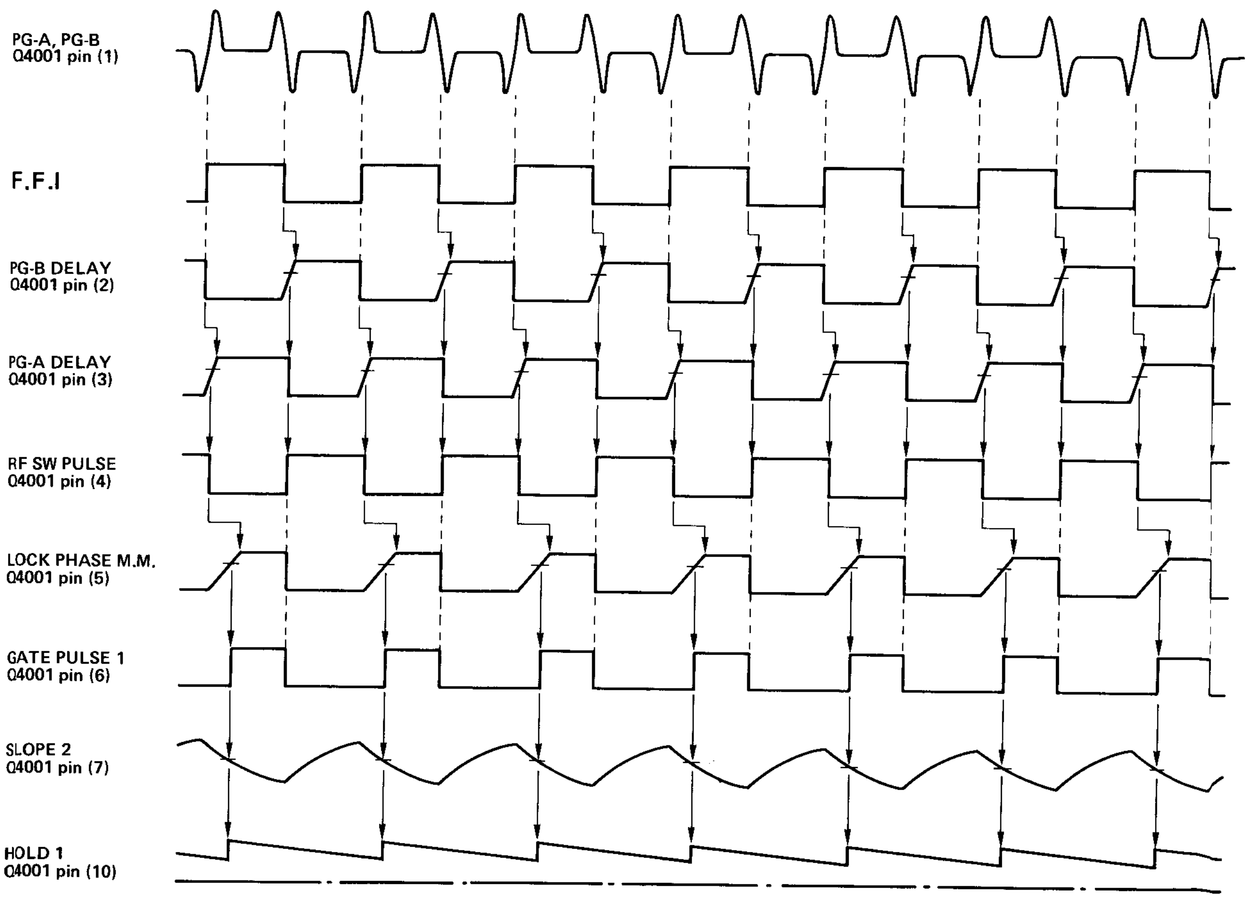


Fig. 2-2-5 Timing chart for drum motor phase control

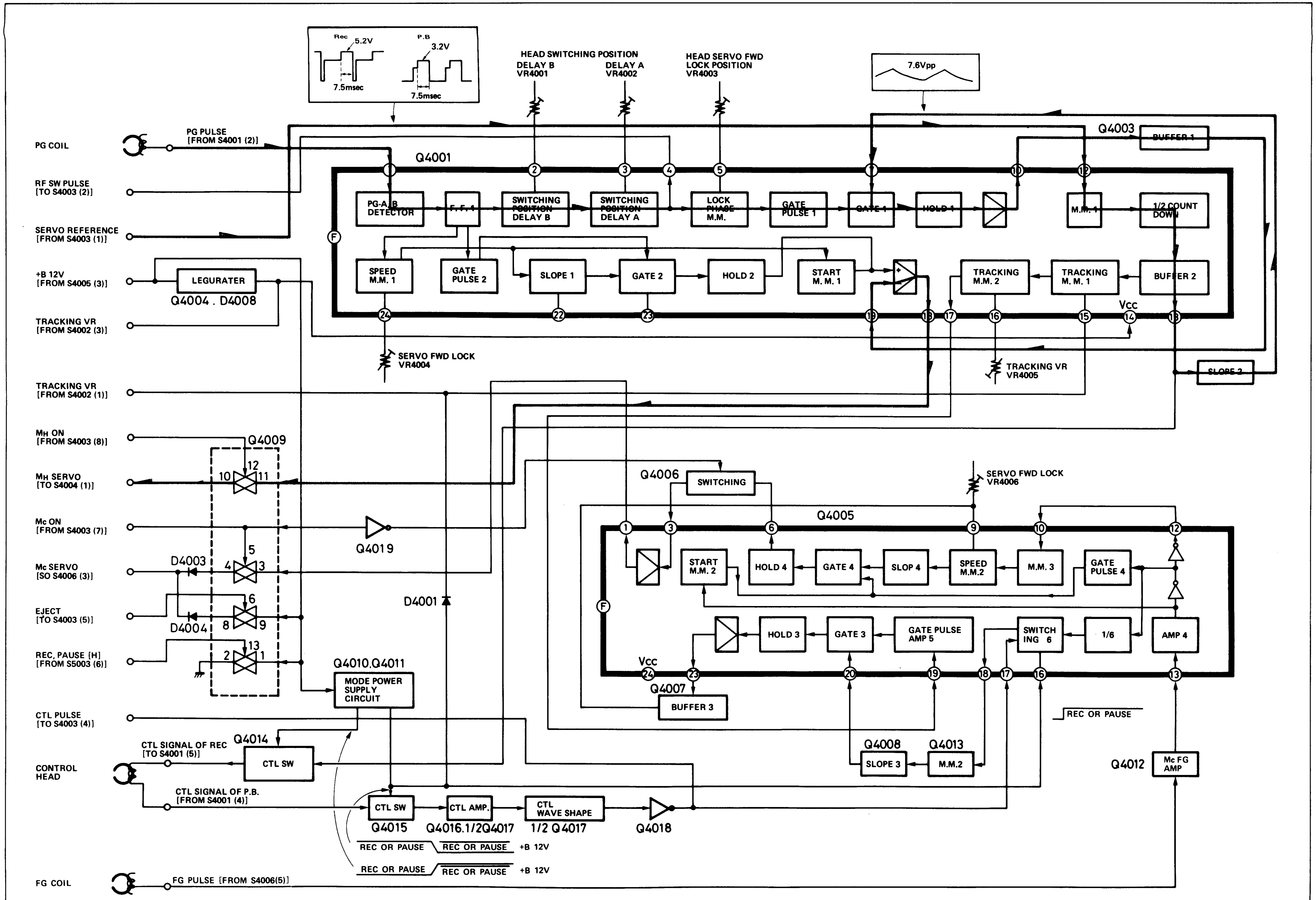

Rec
5.2V
7.5msec
P.B
3.2V
7.5msec
HEAD SWITCHING POSITION
DELAY B
VR4001
DELAY A
VR4002
HEAD SERVO FWD
LOCK POSITION
VR4003
7.6Vpp
PG COIL
PG PULSE
[FROM S4001 (2)]
RF SW PULSE
[TO S4003 (2)]
SERVO REFERENCE
[FROM S4003 (1)]
+B 12V
[FROM S4005 (3)]
TRACKING VR
[FROM S4002 (3)]
TRACKING VR
[FROM S4002 (1)]
MH ON
[FROM S4003 (8)]
MH SERVO
[TO S4004 (1)]
MC ON
[FROM S4003 (7)]
MC SERVO
[SO S4006 (3)]
EJECT
[TO S4003 (5)]
REC, PAUSE (H)
[FROM S5003 (6)]
CTL PULSE
[TO S4003 (4)]
CONTROL
HEAD
FG COIL
Q4001
PG-A/B DETECTOR
F.F. 1
SWITCHING POSITION DELAY B
SWITCHING POSITION DELAY A
LOCK PHASE M.M.
GATE PULSE 1
GATE 1
HOLD 1
M.M. 1
1/2 COUNT DOWN
Q4003
BUFFER 1
SPEED M.M. 1
GATE PULSE 2
SLOPE 1
GATE 2
HOLD 2
START M.M. 1
TRACKING M.M. 2
TRACKING M.M. 1
BUFFER 2
Vcc
SLOPE 2
LEGURATER
Q4004 . D4008
SERVO FWD LOCK
VR4004
TRACKING VR
VR4005
Q4009
Q4019
D4003
D4004
D4001
Q4006
SWITCHING
SERVO FWD LOCK
VR4006
Q4005
START M.M. 2
HOLD 4
GATE 4
SLOP 4
SPEED M.M.2
M.M. 3
GATE PULSE 4
HOLD 3
GATE 3
GATE PULSE AMP 5
SWITCH ING 6
1/6
AMP 4
Vcc
Q4007
BUFFER 3
REC OR PAUSE
Q4010.Q4011
MODE POWER SUPPLY CIRCUIT
Q4014
CTL SIGNAL OF REC
[TO S4001 (5)]
CTL SW
CTL SIGNAL OF P.B.
[FROM S4001 (4)]
CTL SW
CTL AMP.
CTL WAVE SHAPE
Q4015
Q4016.1/2Q4017
1/2 Q4017
Q4018
REC OR PAUSE
REC OR PAUSE
+B 12V
REC OR PAUSE
REC OR PAUSE
+B 12V
Q4008
Q4013
SLOPE 3
M.M.2
Q4012
Mc FG AMP
FG PULSE (FROM S4006(5))

Fig. 2-2-6 Servo circuit block diagram (Drum Motor phase control)

5. Delay of the Reference Signal by 360° (Tracking)

When playing back a cassette tape which has been recorded on a different VCR unit, if there is a difference in the mounting position of the control head between the recording unit and the playback unit, the playback time of the control signal will be misaligned in proportion to the amount of difference in the position. Therefore, the picture on the television screen will be affected by a considerable amount of noise, making viewing difficult.

The circuit which electrically corrects this mechanical misalignment consists of tracking MM1 and tracking MM2 of Q4001. If the position of the control head on the recording unit is misaligned to the negative side of that on the playback unit, the playback time of the control signal will be delayed. In order to align the phase, the playback time must be speeded up. Accordingly, a playback time which is delayed one cycle is adjusted by adjusting the tracking VR which is the time constant circuit of tracking MM2, shortening the delay time, and producing a delayed time which is delayed for slightly less than one cycle. This delayed time is then supplied to the phase control circuit as the playback time of the control signal.

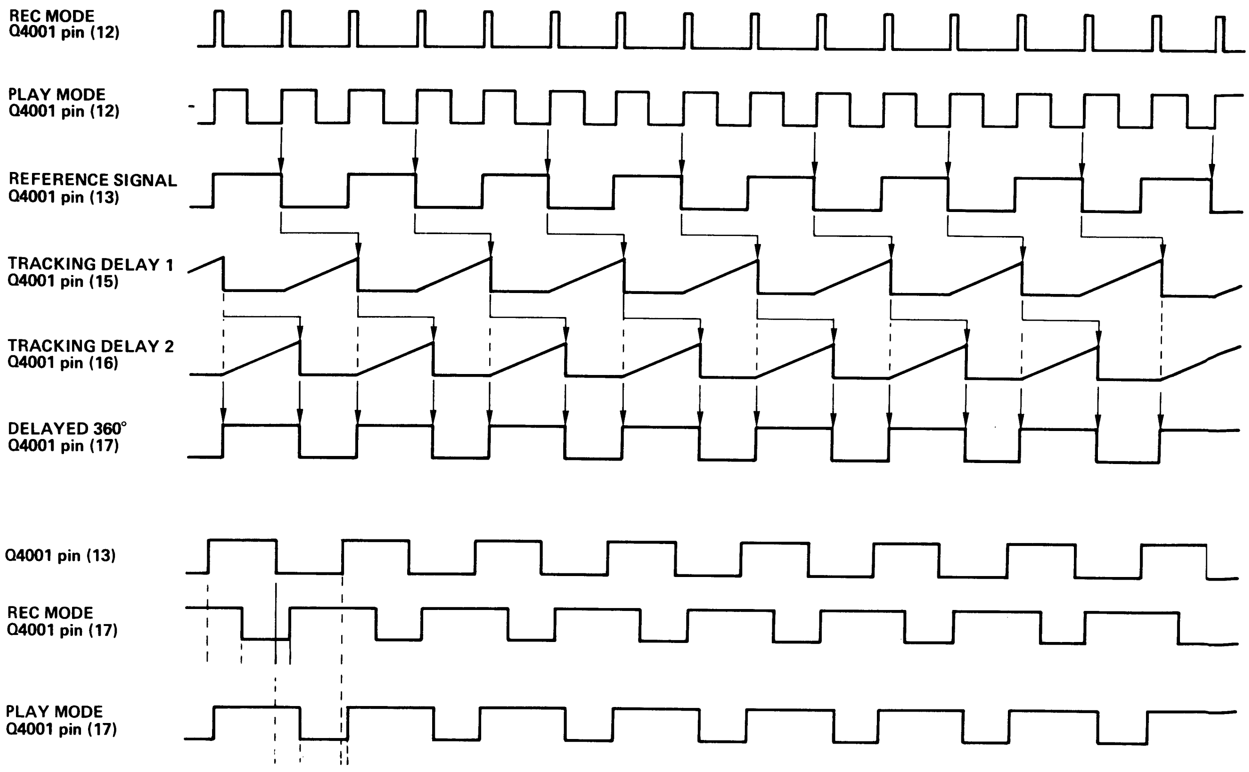

REC MODE
Q4001 pin (12)
PLAY MODE
Q4001 pin (12)
REFERENCE SIGNAL
Q4001 pin (13)
TRACKING DELAY 1
Q4001 pin (15)
TRACKING DELAY 2
Q4001 pin (16)
DELAYED 360°
Q4001 pin (17)
Q4001 pin (13)
REC MODE
Q4001 pin (17)
PLAY MODE
Q4001 pin (17)

Fig. 2-2-7 Timing chart for the reference signal

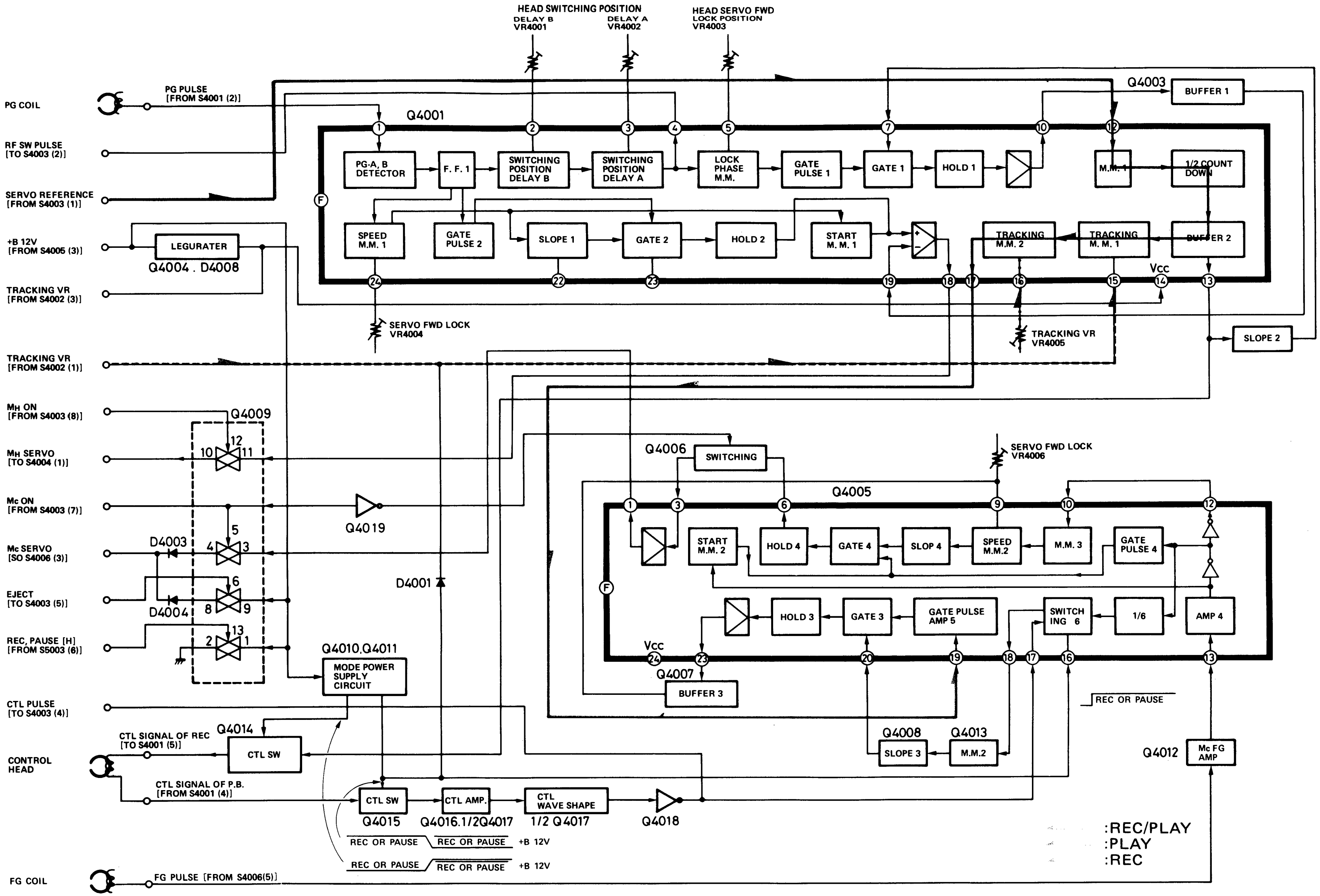

HEAD SWITCHING POSITION
DELAY B
VR4001
DELAY A
VR4002
HEAD SERVO FWD
LOCK POSITION
VR4003
PG COIL
PG PULSE
[FROM S4001 (2)]
RF SW PULSE
[TO S4003 (2)]
SERVO REFERENCE
[FROM S4003 (1)]
+B 12V
[FROM S4005 (3)]
LEGURATER
Q4004 . D4008
TRACKING VR
[FROM S4002 (3)]
Q4001
Q4003
BUFFER 1
PG-A, B DETECTOR
F. F. 1
SWITCHING POSITION DELAY B
SWITCHING POSITION DELAY A
LOCK PHASE M.M.
GATE PULSE 1
GATE 1
HOLD 1
M.M. 1
1/2 COUNT DOWN
SPEED M.M. 1
GATE PULSE 2
SLOPE 1
GATE 2
HOLD 2
START M. M. 1
TRACKING M.M. 2
TRACKING M. M. 1
BUFFER 2
Vcc
SERVO FWD LOCK
VR4004
TRACKING VR
VR4005
SLOPE 2
TRACKING VR
[FROM S4002 (1)]
MH ON
[FROM S4003 (8)]
Q4009
MH SERVO
[TO S4004 (1)]
MC ON
[FROM S4003 (7)]
Q4019
MC SERVO
[SO S4006 (3)]
D4003
EJECT
[TO S4003 (5)]
D4004
REC, PAUSE [H]
[FROM S5003 (6)]
D4001
Q4006
SWITCHING
SERVO FWD LOCK
VR4006
Q4005
START M.M. 2
HOLD 4
GATE 4
SLOP 4
SPEED M.M.2
M.M. 3
GATE PULSE 4
HOLD 3
GATE 3
GATE PULSE AMP 5
SWITCH ING 6
1/6
AMP 4
Vcc
Q4007
BUFFER 3
REC OR PAUSE
Q4010,Q4011
MODE POWER SUPPLY CIRCUIT
CTL PULSE
[TO S4003 (4)]
CTL SIGNAL OF REC
[TO S4001 (5)]
Q4014
CTL SW
CONTROL HEAD
CTL SIGNAL OF P.B.
[FROM S4001 (4)]
CTL SW
CTL AMP.
CTL WAVE SHAPE
Q4015
Q4016.1/2Q4017
1/2 Q4017
Q4018
Q4008
Q4013
SLOPE 3
M.M.2
Q4012
Mc FG AMP
REC OR PAUSE
REC OR PAUSE
+B 12V
REC OR PAUSE
REC OR PAUSE
+B 12V
:REC/PLAY
:PLAY
:REC
FG COIL
FG PULSE [FROM S4006(5)]

Fig. 2-2-8 Servo circuit block diagram (Delay of reference signal)

6. Controlling the Speed of the Capstan Motor

This speed control circuit is almost identical to the speed control circuit of the drum motor. After the trailing edge of the FG pulse which is input to pin (13) of Q4005 is delayed at MM3 and speed MM2, a trapezoidal wave is formed by slope 4, and sent to gate 4 of the gate circuit. The FG pulse which is inverted by the inverter passes through gate pulse 4, and is sent to gate 4. This gate pulse gates the trapezoidal wave at the rise section of the FG pulse, and holds the gated voltage at hold 4.

After the held voltage is current amplified, the capstan servo discrepancy voltage passes from pin (1) of Q4005 through the switching IC (Q4009), and is supplied to the capstan drive circuit.

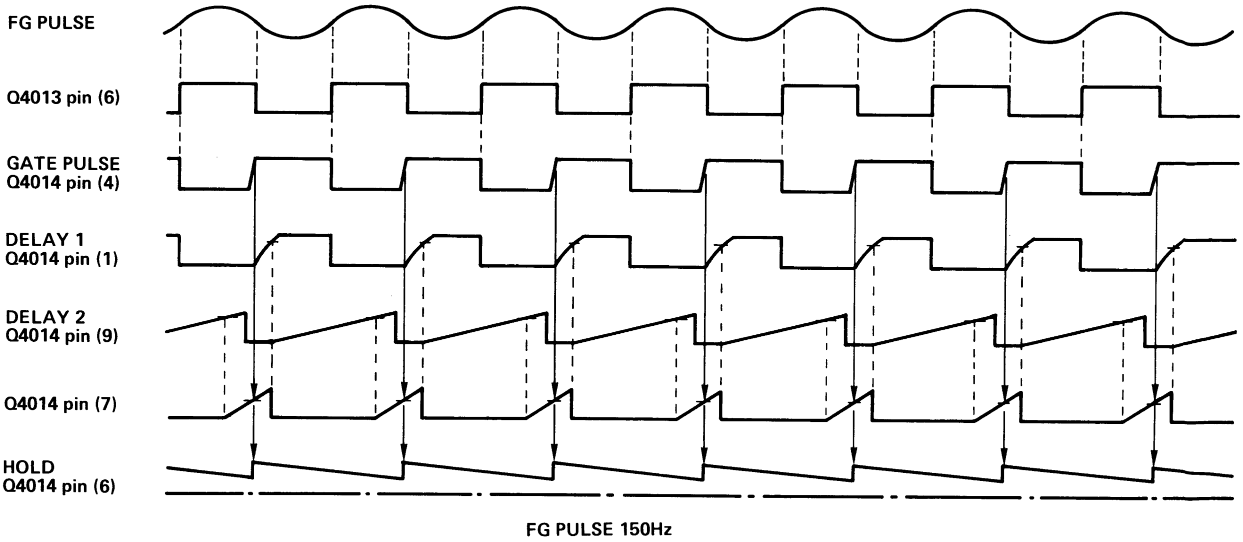


Fig. 2-2-9 Timing chart for capstan motor phase control

7. Frequency Division of the FG Pulse

During recording, it is not necessary to determine the rotation phase of the capstan motor; however, by applying phase control, the rotation of the motor can be precisely controlled. The reference signal of 25 Hz which is employed by the control circuit of the drum motor is also employed as the reference signal of the capstan motor. Therefore, a frequency divider circuit to change the FG pulse to 25 Hz is required.

Because the FG pulse is a frequency of 150 Hz, it must be 1/6 frequency divided. The FG pulse which is input to pin (13) of Q4005 passes through amplifier 4 and the inverter, is divided down to 25 Hz by the 1/6 frequency divider, passes through switching 6, and is output to pin (18) of Q4005. Pin (15) and pin (14) are earthed, and fixed to the 1/6 frequency divider.

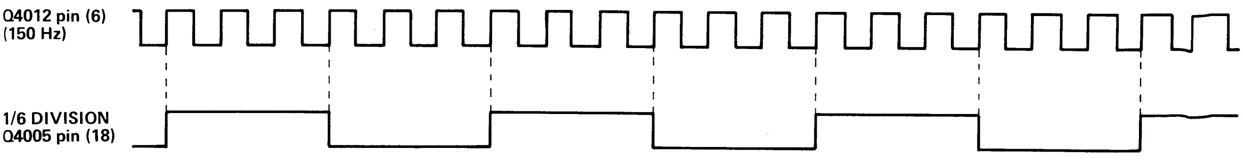


Fig. 2-2-11 Timing chart for FG pulse division

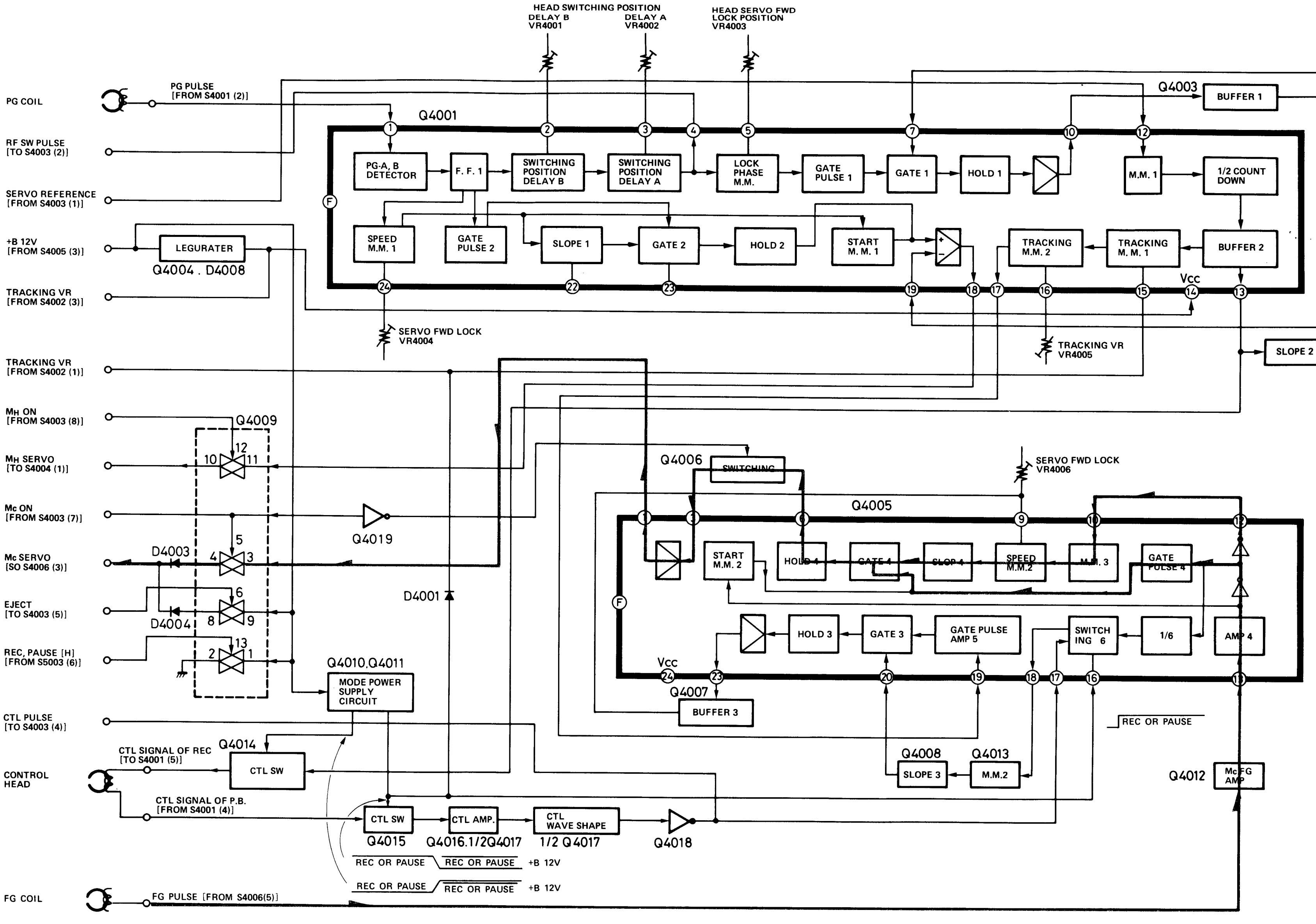

HEAD SWITCHING POSITION
DELAY B
VR4001
DELAY A
VR4002
HEAD SERVO FWD LOCK POSITION
VR4003
PG COIL
PG PULSE [FROM S4001 (2)]
RF SW PULSE [TO S4003 (2)]
SERVO REFERENCE [FROM S4003 (1)]
+B 12V [FROM S4005 (3)]
LEGURATER
Q4004 . D4008
TRACKING VR [FROM S4002 (3)]
Q4001
Q4003
BUFFER 1
PG-A, B DETECTOR
F. F. 1
SWITCHING POSITION DELAY B
SWITCHING POSITION DELAY A
LOCK PHASE M.M.
GATE PULSE 1
GATE 1
HOLD 1
M.M. 1
1/2 COUNT DOWN
SPEED M.M. 1
GATE PULSE 2
SLOPE 1
GATE 2
HOLD 2
START M. M. 1
TRACKING M.M. 2
TRACKING M. M. 1
BUFFER 2
Vcc
SERVO FWD LOCK VR4004
TRACKING VR VR4005
SLOPE 2
TRACKING VR [FROM S4002 (1)]
MH ON [FROM S4003 (8)]
Q4009
MH SERVO [TO S4004 (1)]
Mc ON [FROM S4003 (7)]
Q4019
Mc SERVO [SO S4006 (3)]
D4003
EJECT [TO S4003 (5)]
D4004
REC, PAUSE [H] [FROM S5003 (6)]
D4001
Q4010,Q4011
MODE POWER SUPPLY CIRCUIT
CTL PULSE [TO S4003 (4)]
Q4006
SWITCHING
SERVO FWD LOCK VR4006
Q4005
START M.M. 2
HOLD 4
GATE 4
SLOP 4
SPEED M.M.2
M.M. 3
GATE PULSE 4
HOLD 3
GATE 3
GATE PULSE AMP 5
SWITCH ING 6
1/6
AMP 4
Vcc
Q4007
BUFFER 3
REC OR PAUSE
Q4008
SLOPE 3
Q4013
M.M.2
Q4012
Mc FG AMP
CTL SIGNAL OF REC [TO S4001 (5)]
Q4014
CTL SW
CONTROL HEAD
CTL SIGNAL OF P.B. [FROM S4001 (4)]
CTL SW
Q4015
CTL AMP.
Q4016.1/2Q4017
CTL WAVE SHAPE
1/2 Q4017
Q4018
REC OR PAUSE
REC OR PAUSE
+B 12V
REC OR PAUSE
REC OR PAUSE
+B 12V
FG COIL
FG PULSE [FROM S4006(5)]

Fig. 2-2-11 Servo circuit block diagram (Capstan Motor speed control)

8. Phase Control of the Capstan Motor

During playback, the signal is extracted from the control head, and passes through the control amplifier (Q4016 and Q4017). The playback control signal which is shaped into a square wave passes through the inverter (Q4018) and MM2 (Q4013), is shaped into a trapezoidal wave by slope 3 (Q4008), and then sent to gate 3 [pin (20) of Q4005]. As for the gate pulse, the signal which delayed the reference signal by 360° at tracking MM1 and tracking MM2 of Q4001 enters gate 3, and the trapezoidal wave is gated. After this gated voltage is held at hold 3 and current amplified, it then passes through buffer 3 (Q4007), and is sent into the speed control circuit.

During recording, the FG pulse which was 1/6 frequency divided passes through the MM2 IC (Q4013), is shaped into a trapezoidal wave by slope 3 (Q4008), and is then sent to gate 3 [pin (20) of Q4005]. The gate pulse is output from pin (17) of Q4001 just as it is during playback; however, because a section of the time constant circuit of tracking MM1 is the tracking VR (VR4004), switching 4 (D4001) is employed so that the delay time of tracking MM1 does not change, even if the tracking VR (VR4005) varies. The trapezoidal wave of the FG pulse is gated by this gate pulse, and then, just as during playback, is held at hold 3, current amplified, and sent to the speed control circuit.

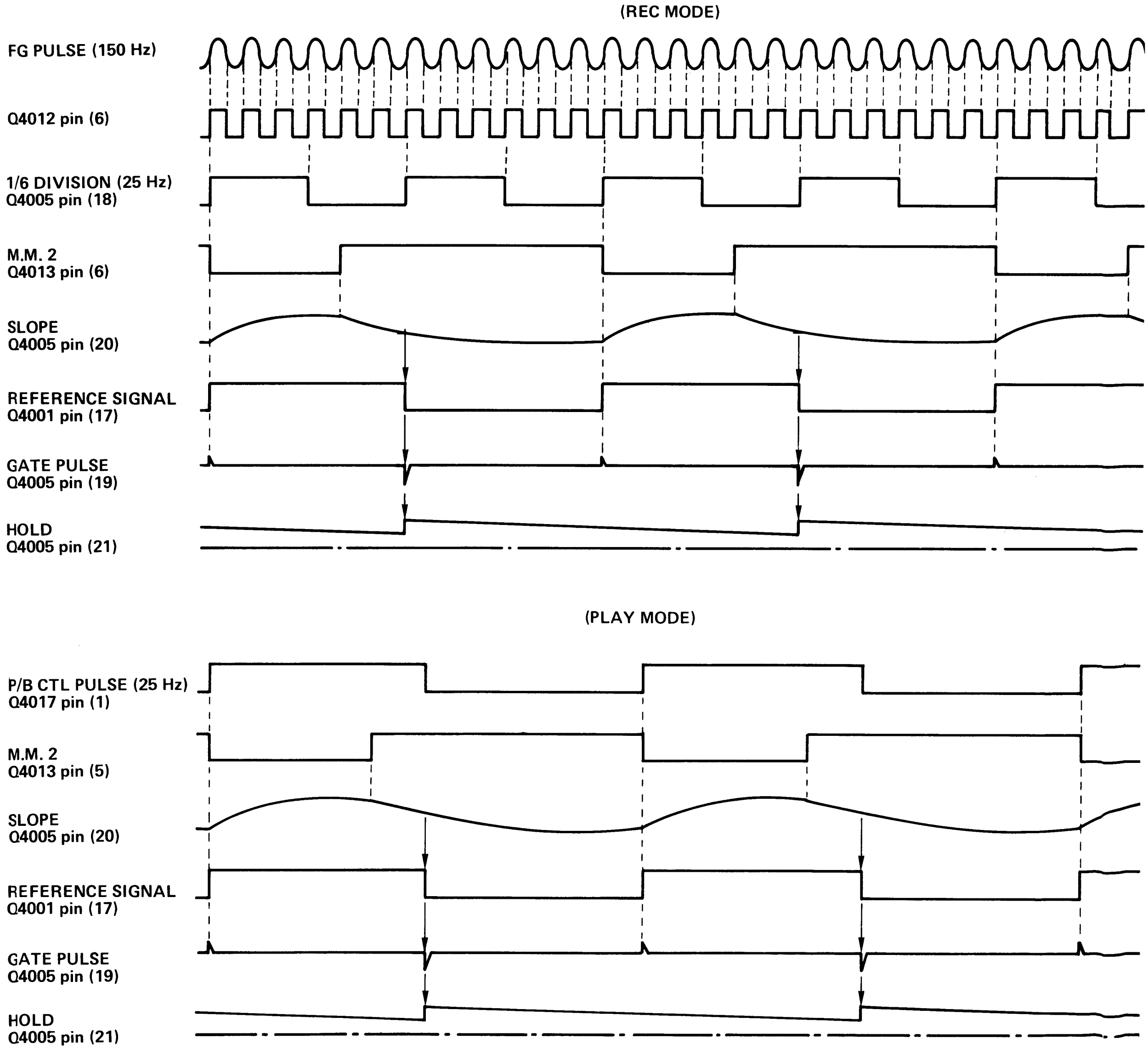

(REC MODE)
FG PULSE (150 Hz)
Q4012 pin (6)
1/6 DIVISION (25 Hz)
Q4005 pin (18)
M.M. 2
Q4013 pin (6)
SLOPE
Q4005 pin (20)
REFERENCE SIGNAL
Q4001 pin (17)
GATE PULSE
Q4005 pin (19)
HOLD
Q4005 pin (21)
(PLAY MODE)
P/B CTL PULSE (25 Hz)
Q4017 pin (1)
M.M. 2
Q4013 pin (5)
SLOPE
Q4005 pin (20)
REFERENCE SIGNAL
Q4001 pin (17)
GATE PULSE
Q4005 pin (19)
HOLD
Q4005 pin (21)

Fig. 2-2-12 Timing chart for capstan motor speed control

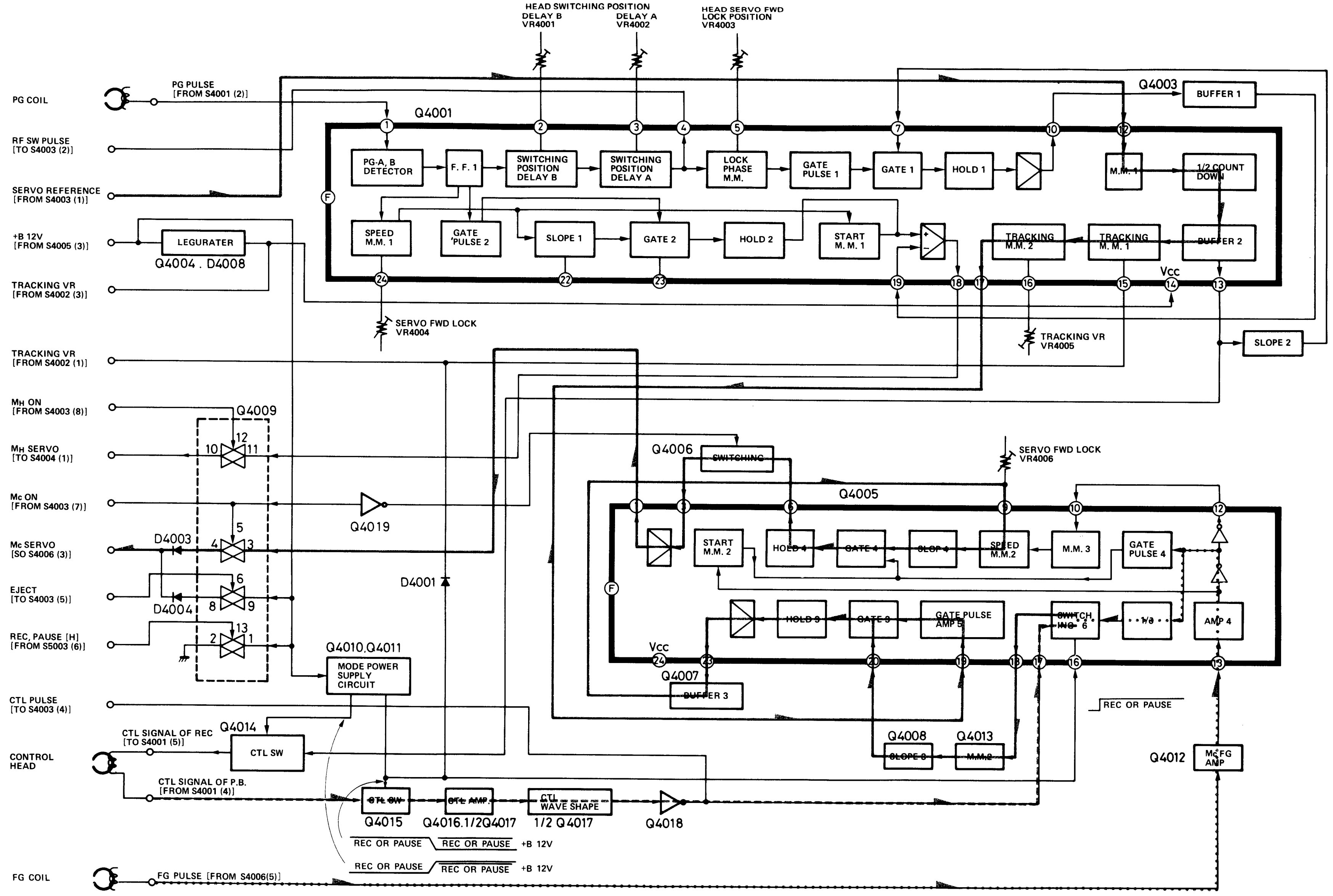

HEAD SWITCHING POSITION
DELAY B
VR4001
DELAY A
VR4002
HEAD SERVO FWD
LOCK POSITION
VR4003
PG COIL
PG PULSE
[FROM S4001 (2)]
RF SW PULSE
[TO S4003 (2)]
SERVO REFERENCE
[FROM S4003 (1)]
+B 12V
[FROM S4005 (3)]
TRACKING VR
[FROM S4002 (3)]
TRACKING VR
[FROM S4002 (1)]
MH ON
[FROM S4003 (8)]
MH SERVO
[TO S4004 (1)]
MC ON
[FROM S4003 (7)]
MC SERVO
[SO S4006 (3)]
EJECT
[TO S4003 (5)]
REC, PAUSE [H]
[FROM S5003 (6)]
CTL PULSE
[TO S4003 (4)]
CONTROL
HEAD
CTL SIGNAL OF REC
[TO S4001 (5)]
CTL SIGNAL OF P.B.
[FROM S4001 (4)]
FG COIL
FG PULSE [FROM S4006(5)]
Q4001
PG-A, B
DETECTOR
F. F. 1
SWITCHING
POSITION
DELAY B
SWITCHING
POSITION
DELAY A
LOCK
PHASE
M.M.
GATE
PULSE 1
GATE 1
HOLD 1
Q4003
BUFFER 1
M.M. 1
1/2 COUNT
DOWN
BUFFER 2
SPEED
M.M. 1
GATE
PULSE 2
SLOPE 1
GATE 2
HOLD 2
START
M. M. 1
TRACKING
M.M. 2
TRACKING
M. M. 1
Vcc
F
LEGURATER
Q4004 . D4008
SERVO FWD LOCK
VR4004
TRACKING VR
VR4005
SLOPE 2
Q4009
Q4019
D4003
D4004
D4001
Q4006
SWITCHING
SERVO FWD LOCK
VR4006
Q4005
START
M.M. 2
HOLD 4
GATE 4
SLOPE 4
SPEED
M.M.2
M.M. 3
GATE
PULSE 4
HOLD 3
GATE 3
GATE PULSE
AMP 5
SWITCH-
ING 6
1/3
AMP 4
Vcc
Q4007
BUFFER 3
REC OR PAUSE
Q4008
Q4013
SLOPE 3
M.M.2
Q4012
MC FG
AMP
Q4010.Q4011
MODE POWER
SUPPLY
CIRCUIT
Q4014
CTL SW
CTL SW
CTL AMP.
CTL
WAVE SHAPE
Q4015
Q4016.1/2Q4017
1/2 Q4017
Q4018
REC OR PAUSE
REC OR PAUSE
+B 12V
REC OR PAUSE
REC OR PAUSE
+B 12V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
22
23
24

Fig. 2-2-13 Servo circuit block diagram (Capstan Motor phase control)

:REC/PLAY
:PLAY
:REC

9. Smooth Starting of the Capstan Motor Rotation (Q4019 and Q4006)

When the capstan motor is not in motion (i.e., when the Mc ON signal is LOW), capacitor C4012 for the equalizer of pin (3) of Q4012 is charged, and, if the motor is rotated at this time (i.e., the Mc ON signal becomes HIGH), a high voltage is output from pin (1) of Q4012 as the capstan control voltage. Thus, the motor suddenly begins to rotate, without having a smooth start. Therefore, if, when the capstan motor is not in motion, the charging voltage is adjusted so that it decreases, the motor will begin to rotate slowly with a smooth start. This adjustment is made by the circuit composed of Q4006 and Q4019. The Mc ON LOW level is inverted by Q4019, and Q4006 is switched ON.

10. Capstan Motor Rotation During Eject Operation

When a cassette is to be ejected, the capstan motor is rotated in order to trigger the eject lever. When the eject signal from the system control circuit enters pin (6) of Q4009 (analog switch), the capstan control signal is output from pin (8) through D4004, and the motor begins to rotate.

11. Power Supply Stabilization of the Head Motor Servo IC (Q4004)

By means of a transistor Q4004 and a zener diode (D4008), the supply voltage of the head motor servo IC (Q4001) is made constant so that the head servo circuit maintains stable operation with regard to fluctuations in the power supply.

12. Power Supply for the Various Modes (Q4010 and Q4011)

This circuit supplies the two types of voltage required by the servo circuit, 12 V during recording and 12 V for playback.

13. Recording and Playback of the Control Signal (Q4014 ~ Q4017)

The vertical synchronizing signal (reference signal) which is input to pin (12) of Q4001 during recording is 1/2 frequency divided. This frequency divided vertical synchronizing signal is recorded onto the lower edge of the tape by Q4014 as the control signal which indicates the recording position of the video signal.

During playback the control signals which are played back through Q4016 and Q4017 are amplified, changed into square waves, passed through the Q4018 inverter, and then sent to the system control circuit and pin (17) of Q4005. The recording head for the control signal is also the playback head. Q4014 and Q4015 are switched (each is switched so that the terminal is earthed) by the recording 12 V and the playback 12 V, respectively, thus using the head for both recording and playback, as appropriate.

14. FG Amplifier (Q4012)

Because the signal generated by the frequency generator (FG) of the capstan motor is small and in the form of a sine wave, it cannot be used as a servo signal. Therefore, the Q4012 FG pulse amplifier serves the function of amplifying this FG signal and changing the waveform into a square wave.

15. Head Motor and Capstan Motor

a. Head motor (video drum drive motor)

The head motor employs an 8-pole magnet as the rotor and a 3-phase drive stator with a total of 12 coils (four coils for each phase) wound around a core having 12 protruding poles. This is an outer-rotor type brushless motor, and is a direct-drive system. In addition, Hall-effect elements are used for position detection of the rotor.

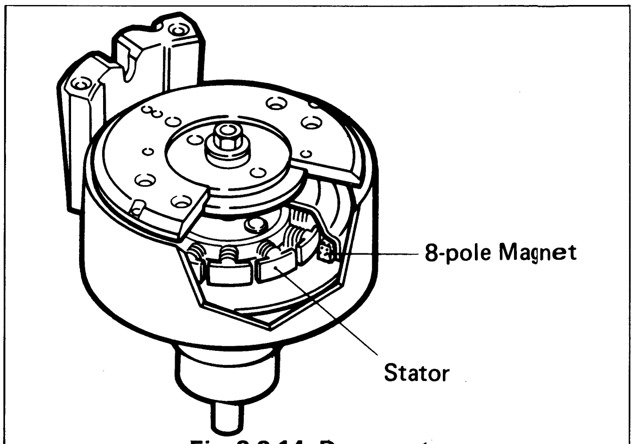


Fig. 2-2-14 Drum motor

b. Capstan motor

The capstan motor is a flat-type coreless, brushless motor which employs an 8-pole magnet as the rotor and a 3-phase stator with a total of six air-core coils (2coils for each phase), and is also a direct-drive system. Hall-effect elements are used for position detection of the rotor.

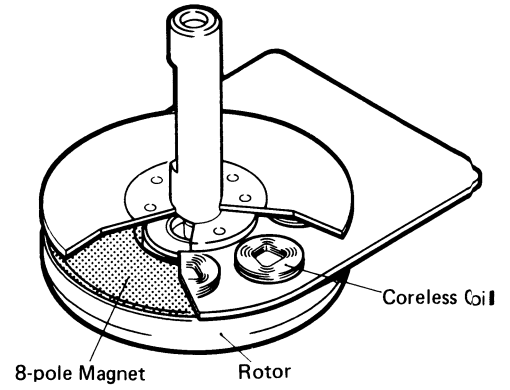


Fig. 2-2-15 Capstan motor

c. Fundamental operation of a brushless motor

In a brushless motor, magnets are used in the rotor and drive coils are used in the stator. Position detectors (Hall-effect elements, for example) for the rotor, as well as a commutation circuit are necessary in order to assure smooth rotation of the rotor. The position detectors and the commutation circuit are the parts of a brushless motor which are equivalent to a brush and a commutator.

The position detectors and the commutation circuit must perform the function of electronically switching the drive coils, which must cause current to flow, according to the mutual positions of the drive coils and the rotor magnets.

A 3-phase drive brushless motor will be considered as an example. Fig. 2-2-16 is a simplified illustration of the circuit. There is a 3-phase (L1, L2, and L3) drive coil. Hall-effect elements (Q1, Q2, and Q3) used as position detectors are arranged at electrical angles of 120° intervals. When power is input under these conditions, one (Q1 for example) of the position detectors (Q1, Q2, and Q3) emits a HIGH signal as output. As a result, continuity exists only for transistor Q4, and current flows to L1, thus causing the rotor to rotate. Next, only Q3 emits the HIGH signal as output, continuity exists only for Q5, current flows to L2, and the rotation of the rotor is continued. As a result, only Q3 emits the HIGH signal as output, continuity exists only for Q6, current flows to L3, and rotation continues. In this way, the rotor is rotated by the flow of current to the 3-phase drive coil in the order L1 → L2 → L3 → L1.

As described previously, because the rotation is smooth, due to the position detectors (Q1, Q2, and Q3) and the commutating circuit (Q4, Q5, and Q6) repeating their switching ON and OFF in order with no duplication and no interruption, a differential-like action is created in the commutation circuit, and, for the 3-phase drive system, the commutation circuit is usually composed of a three-differential circuit.

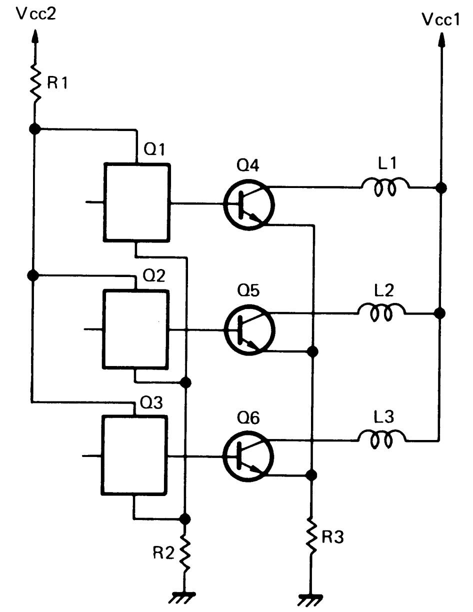


Fig. 2-2-16 Motor drive circuitry

d. Fundamental operation of the head motor

The head motor is composed of mainly two IC chips and three Hall elements.

The circuit diagram in Fig. 2-2-17, and the waveforms shown in Fig. 2-2-18 will be used for the explanation of the fundamental operation of the head motor drive circuit.

The head motor has three Hall elements (Q4351, Q4352, and Q4353) arranged in locations corresponding to each drive coil of each phase. The output signals from these three Hall elements are output as the waveform shown in Fig. 2-2-18 (a) according to the positions of the rotor magnets. The signal from Q4351 is input to pin (15) and pin (16) of Q4354, the signal from Q4352 is input to pin (13) and pin (14), and the signal from Q4353 is input to pin (11) and pin (12).

Because the output of the Hall elements is very fine, the various outputs are amplified within Q4354, and then input to the three-differential circuit. This three-differential circuit is the switching circuit by which the current flowing to the drive coil is electronically switched in order. Following this, the output signal of the three-differential circuit is amplified, and then, output signals such as that shown in Fig. 2-2-18 (b) are output, as follows: The output corresponding to Q4351 is output to pin (17) and pin (1) of Q4354, the output corresponding to Q4352 is output to pin (2) and pin (3) of Q4354, and the output corresponding to Q4353 is output to pin (4) and pin (5) of Q4354.

The output of Q4354 is input in order to drive Q4355. In other words, the respective inputs are as follows:

From pin (17) of Q4354 to pin (3) of Q4355
From pin (1) of Q4354 to pin (2) of Q4355
From pin (2) of Q4354 to pin (8) of Q4355
From pin (3) of Q4354 to pin (7) of Q4355
From pin (4) of Q4354 to pin (6) of Q4355
From pin (5) of Q4354 to pin (5) of Q4355

Q4355 is the driver which causes current to flow to the drive coils, and the construction is, as shown in Fig. 2-2-15, a push-pull amplifier circuit. The drive coils are connected to output pins (12), (10) and (11) of Q4355. These outputs correspond to the Hall elements (Q4351, Q4352, and Q4353). Signals such as those shown in Fig. 2-2-14 (c) and (d) are output, and current flows, in order, in both directions to each drive coil according to the output of the Hall elements. As a result, the rotor is able to rotate smoothly and evenly.

The speed-control signals are input to pin (8) of Q4354. These signals are amplified and controlled within Q4354, and the size of the output current of the driver IC of Q4355 is thus regulated. As a result, the rotor operates in response to the speed-control signals, thereby rotating at a constant speed.

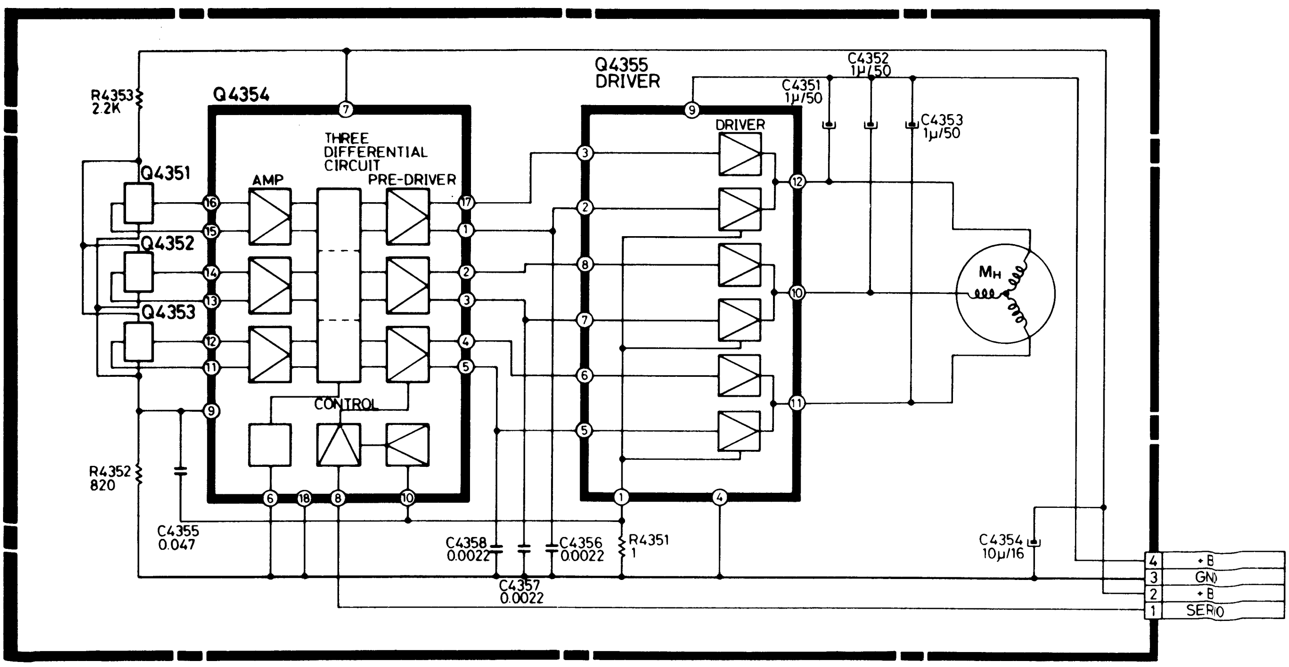


Fig. 2-2-17 Drum motor circuit schematic diagram

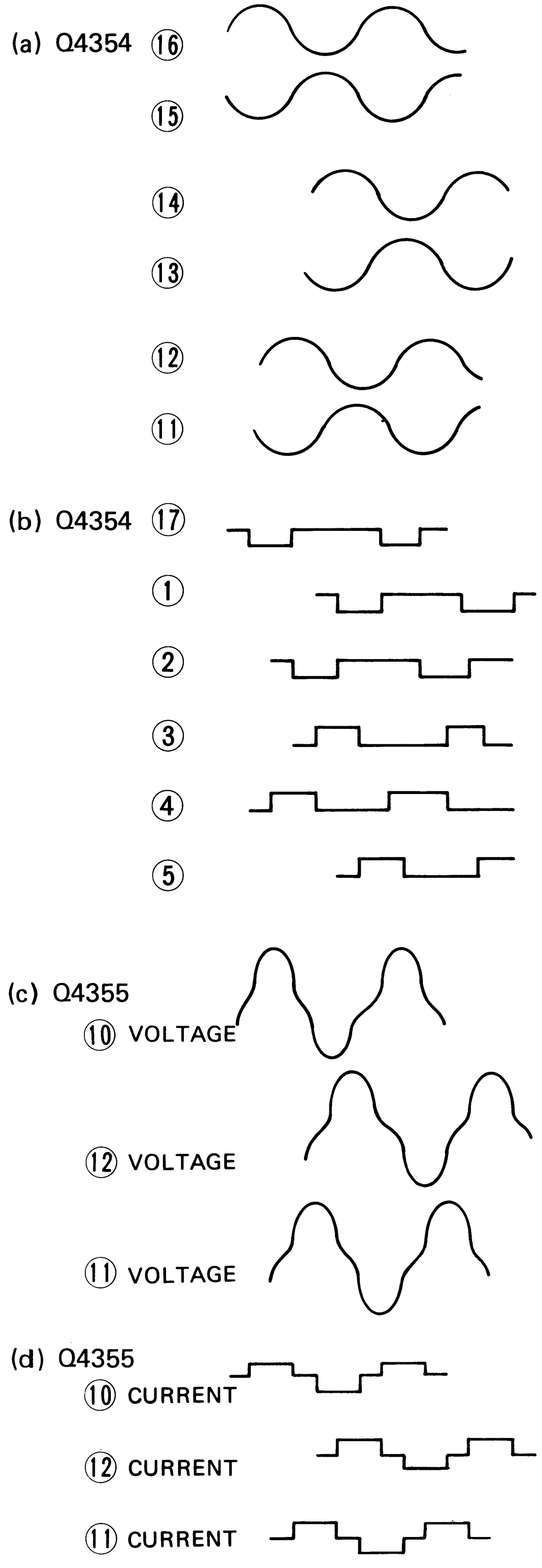


Fig. 2-2-18 Input and output signals timing chart

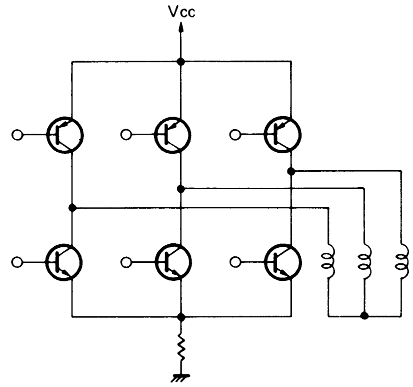


Fig. 2-2-19 Q4355

e. Fundamental operation of the capstan motor

The capstan motor circuit is mainly composed of a one-chip IC and three Hall elements.

The circuit diagram in Fig. 2-2-20 and the waveforms shown in Fig. 2-2-21 will be used for the explanation of the fundamental operation of the capstan motor drive circuit.

In the capstan motor, the three Hall elements (Q4301, Q4302, and Q4303) are arranged in locations corresponding to each of the three drive coils of the three phases. The output signals from these three Hall elements are, depending on the position of the magnets of the rotor, as shown in Fig. 2-2-21 (a). These signals are amplified, respectively, by Q4305, Q4306, and Q4307, and are then input to pins (2), (3), and (4) of Q4304. After being further amplified within Q4304, the signals are input to the three-differential circuit.

This three-differential circuit is the switching circuit by which the current flowing to the drive coils is electronically switched in order. Then, the output signal of the three-differential circuit is input to the three-system driver circuit in order to activate the driver circuit within Q4304. This driver circuit is, the same as the head motor, a push-pull amplifier circuit. The construction is shown in Fig. 2-2-19. Drive coils are connected to the driver circuit as the load. In other words, the signal shown in Fig. 2-2-21 (b) and (c) is output to pin (14), pin (13), and pin (12) of Q4304 according to the output of the Hall elements (Q4301, Q4302, and Q4303), and current flows in order to each coil in both directions. The operation of this circuit is the same as that for the head motor, and the current flow is shown in simplified form in Fig. 2-2-22. In other words, at the first condition (a), position detector S1 switches ON in accordance with the position of the rotor. Current then flows from Q1, passes through the drive coils, and flows to Q2 and Q3. As a result, the rotor rotates in the direction of the arrow in the (a) figure. Rotation continues, and, when S2 switches ON in accordance with the position of the rotor, the condition changes to the second condition (b). Next, current flows from Q2 to Q1 and Q3, passing through the drive coils, thereby causing the rotor to rotate further in the direction of the arrow.

Next, when S3 switches ON, the third condition (c) occurs; rotation continues further, the condition returns to the first condition (a), and rotation becomes continuous.

The rotation speed of the capstan motor is detected by the speed generator, and, after the speed is compared with the standard reference signal by the servo circuit, the output is input to pin (8) of Q4304. It is then control-amplified by Q4304, and input by the three-differential circuit. This controls the base current of the driver circuit, and, as a result, the current flow to the drive coils which is the load of the driver circuit is increased or decreased, thus changing the rotation speed. As a result, the motor rotates at a constant speed in accordance with the speed-control signal.

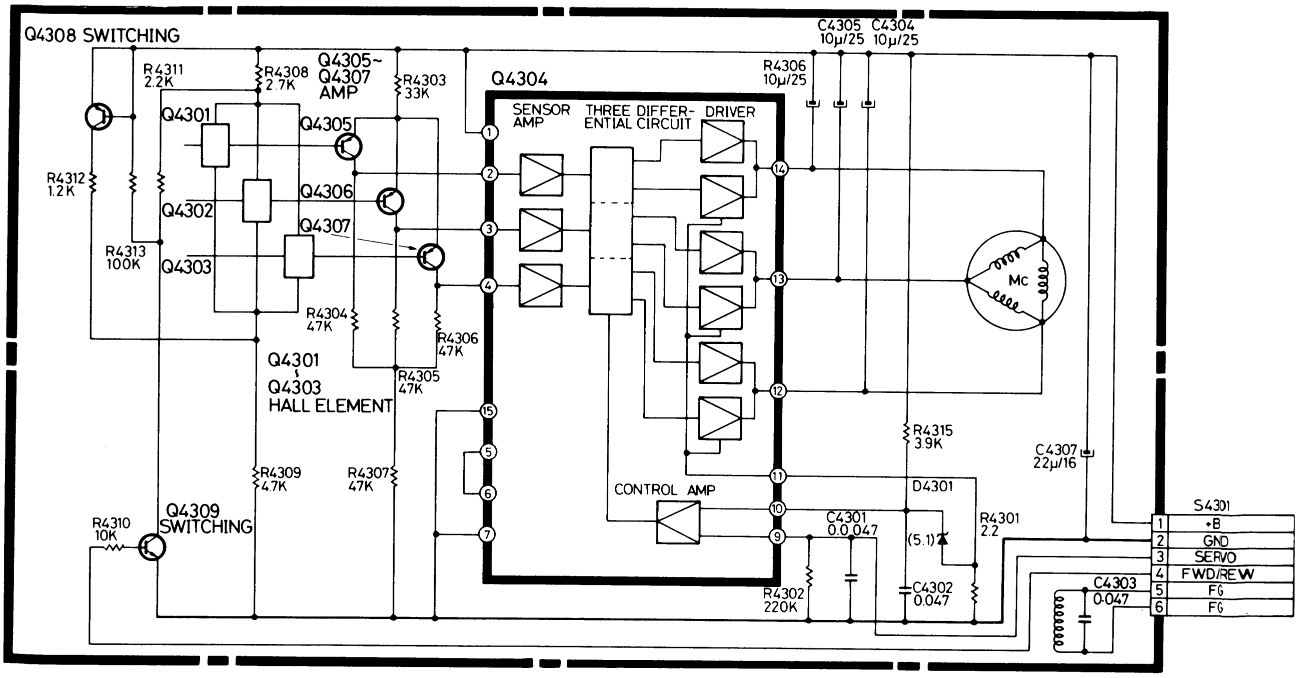

Q4308 SWITCHING
R4311 2.2K
R4308 2.7K
Q4305~Q4307 AMP
R4303 33K
Q4304
C4305 10μ/25
C4304 10μ/25
R4306 10μ/25
Q4301
Q4305
SENSOR AMP
THREE DIFFERENTIAL CIRCUIT
DRIVER
R4312 1.2K
Q4302
Q4306
Q4307
R4313 100K
Q4303
Mc
R4304 47K
R4306 47K
Q4301 ~ Q4303 HALL ELEMENT
R4305 47K
R4315 3.9K
C4307 22μ/16
R4309 4.7K
R4307 47K
CONTROL AMP
D4301
S4301
R4310 10K
Q4309 SWITCHING
C4301 0.0047
(5.1)
R4301 2.2
1 +B
2 GND
3 SERVO
4 FWD/REW
5 FG
6 FG
C4303 0.047
R4302 220K
C4302 0.047
1
2
3
4
5
6
7
9
10
11
12
13
14
15

Fig. 2-2-20 Capstan motor schematic diagram

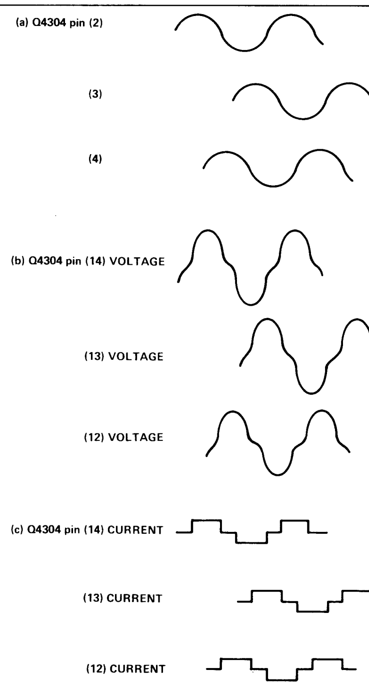


Fig. 2-2-21 Output signal timing chart

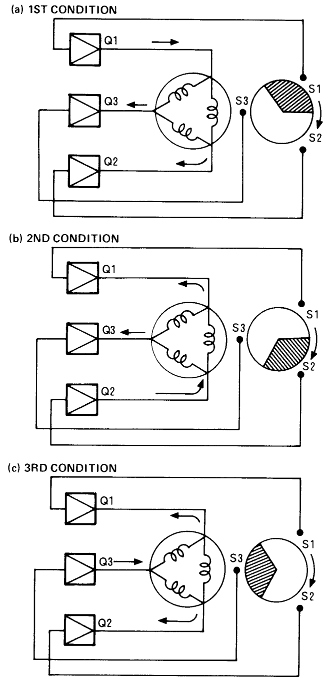

(a) 1ST CONDITION
Q1
Q3
Q2
S1
S2
S3
(b) 2ND CONDITION
Q1
Q3
Q2
S1
S2
S3
(c) 3RD CONDITION
Q1
Q3
Q2
S1
S2
S3

Fig. 2-2-22 Motor drive condition

IV. SYSTEM CONTROL CIRCUIT

A. SUMMARY

1. Main Functions of the System Control Circuit

- a. Logic control of the feather-touch operation buttons.
- b. Activation of the three solenoids (pinch roller, fast forward/rewind, and eject) and driving of the three motors (head, capstan, and reel), and also control of the various mechanisms.
- c. Detection through the various sensors, and, if an abnormality is discovered, automatic stopping of the VCR.
- d. Sending of a control signal to the video, audio, servo, and timer circuits.

2. Main Features of the System Control Circuit

- a. Uses N-channel, 4-bit, 1-chip microcomputer LM-6402A (Q3001) for the control IC.
- b. Includes input expander LC7800 (Q3002 and Q3003) for expansion of microcomputer system input; circuit construction has been simplified.
- c. Two-chip construction for various sensor circuits [tape and sensor circuit LA7011 (Q3005) and the other sensor circuit BA6135 (Q3006)].

3. New Circuitry

- a. Four-bit, 1-chip microcomputer LM6402A (Q3001) developed as a microcomputer for VCR control use, and the following functions added:
  - (1) Electronic eject function.
  - (2) In order to protect video heads and video tape, five-minute timer function for returning unit to the STOP mode after five minutes in the PAUSE mode.
- b. By including an input expander LC7800 (Q3002 and Q3003) for expansion of the microcomputer input, and converting the 31 input signals to four signals by using a 2-chip IC, the circuit construction of the microcomputer input circuit was simplified.
- c. The 1-chip BA6135 (Q3006) is used for the dew sensor, the reel base rotation sensor, and the control pulse detection circuit.

4. Modes of the VCR

The following modes are classified according to the input of the VCR operation buttons and controls:

- a. LOADING mode
- b. UNLOADING mode
- c. STOP mode
- d. REC mode
- e. PLAY mode
- f. PAUSE mode
- g. F FWD mode
- h. REW mode
- i. CASSETTE-UP mode

The conditions required for each mode are shown below. The mode will occur if and when any one set of the appropriate conditions exists.

a. LOADING mode

- (1) While power is being supplied, the cassette switch is ON [pin (16) of Q3003 is LOW] and the loading switch is OFF [pin (18) of Q3003 is HIGH].
- (2) While in the CASSETTE-UP mode, the cassette switch becomes ON [pin (16) of Q3003 is LOW].

b. UNLOADING mode

The EJECT button (SW3406) of the operation circuit board (SY-2) becomes ON, and, following that, the eject switch also becomes ON [pin (15) of Q3003 is LOW].

c. STOP mode

- (1) The STOP button (SW3402) of the operation circuit board (SY-2) becomes ON.
- (2) While in the REW mode, the REW STOP signal [pin (17) of Q3002] changes from HIGH to LOW (the counter RESET button is ON).
- (3) While the tape is moving in the forward direction, the rewind sensor signal [pin (11) of Q3002] becomes LOW (at the end of the tape).
- (4) While the tape is moving in the rewind direction, the forward sensor signal [pin (10) of Q3002] becomes LOW (at the end of the tape).
- (5) The dew sensor signal [pin (9) of Q3002] becomes LOW.
- (6) While the tape is moving, the reel base rotation sensor signal [pin (12) of Q3002] becomes LOW (when the reel base stops rotating).

d. REC mode

- (1) The timer recording signal is input [pin (16) of Q3002 is LOW].
- (2) While in any one of the STOP, PLAY, F FWD, or REW modes, the LOCK button (SW3409) and also the REC button (SW3407) become ON.
- (3) While in the PAUSE mode, the PAUSE button (SW3405) becomes ON.

e. PLAY mode

While in any one of the STOP, REC, F FWD, or REW modes, the PLAY button (SW3401) becomes ON.

f. PAUSE mode

While in the REC mode, the PAUSE button (SW3405) becomes ON.

g. F FWD mode

While in any one of the STOP, REC, PAUSE, or REW modes, the F FWD button (SW3404) becomes ON.

h. REW mode

While in any one of the STOP, REC, PAUSE, or F FWD modes, the REW button (SW3403) becomes ON.

i. CASSETTE-UP mode

The cassette SW becomes OFF [pin (16) of Q3003 becomes HIGH].

B. CIRCUIT EXPLANATION

1. Microcomputer System

a. Hard construction

The microcomputer system is shown in Fig. 2-3-1. It consists of the one-chip microcomputer LM6402 (Q3001), the input expander LC7800 (Q3002 and Q3003), and the output decoder TC4028 (Q3004).

The 31 input signals which are input to the two input expanders Q3002 and Q3003 are converted to four 0

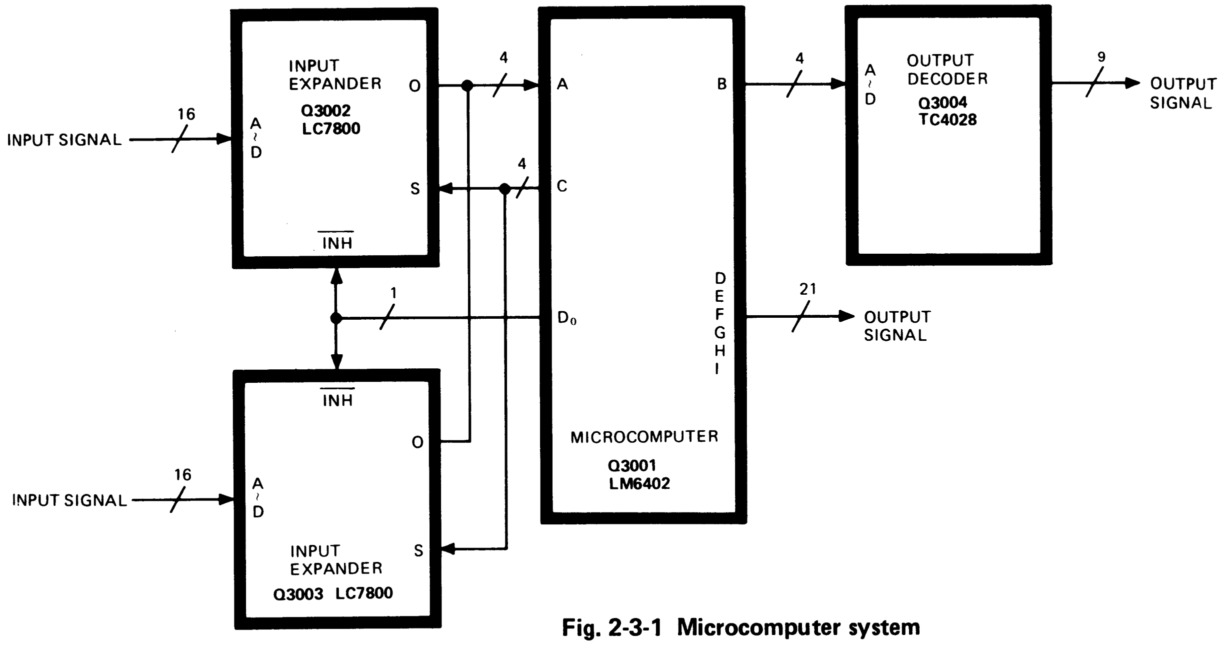

INPUT SIGNAL
16
INPUT EXPANDER
Q3002
LC7800
A/D
O
S
INH
4
4
1
INPUT SIGNAL
16
INH
O
A/D
S
INPUT EXPANDER
Q3003 LC7800
A
C
D₀
B
D E F G H I
MICROCOMPUTER
Q3001
LM6402
4
A/D
OUTPUT DECODER
Q3004
TC4028
9
OUTPUT SIGNAL
21
OUTPUT SIGNAL

Fig. 2-3-1 Microcomputer system

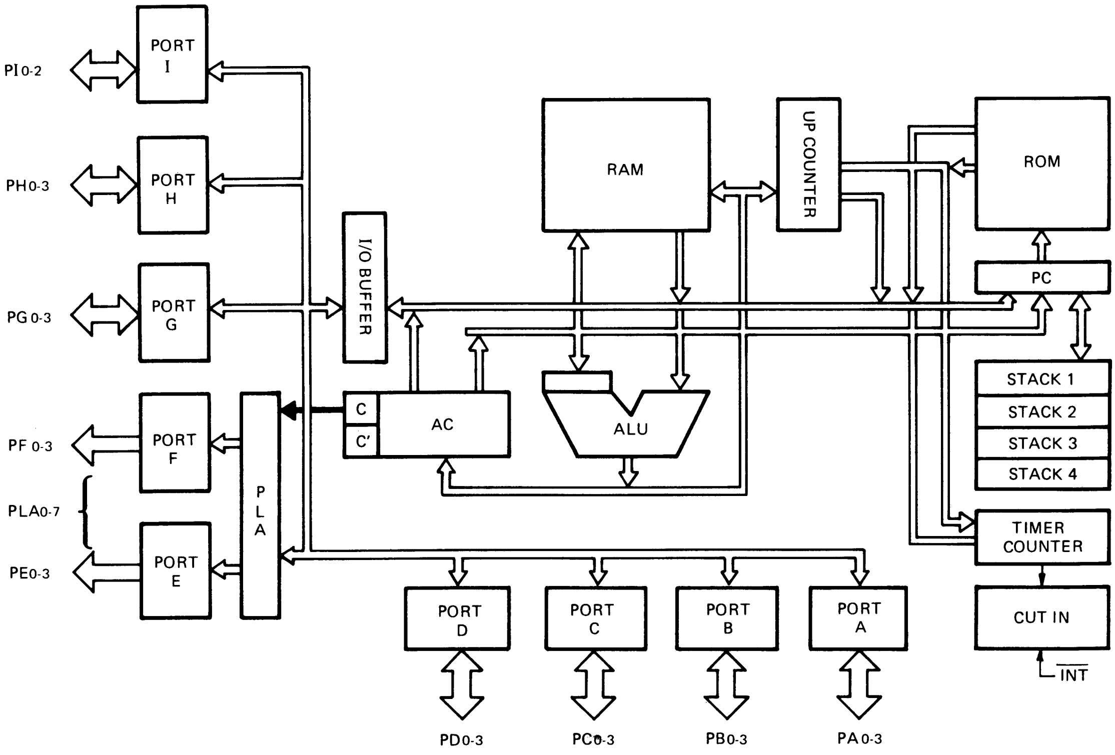

PI0-2
PORT I
PH0-3
PORT H
PG0-3
PORT G
PF0-3
PORT F
PLA0-7
PE0-3
PORT E
PLA
I/O BUFFER
C
C'
AC
RAM
ALU
UP COUNTER
ROM
PC
STACK 1
STACK 2
STACK 3
STACK 4
TIMER COUNTER
CUT IN
INT
PORT D
PORT C
PORT B
PORT A
PD0-3
PC0-3
PB0-3
PA0-3

Fig. 2-3-2 Block diagram of Q3001 (LM6402)

output signals, and then input to the 4-bit, 1-chip microcomputer.

At the 4-bit microcomputer LM6402 (Q3001), treatment corresponding to the four input signals is accomplished, and signals are then output to ports B, D, E, F, G, and I. The roles of the various output ports of LM6402 are shown below:

(1) Port A: 4-bit input data
(2) Port B: mode signal expressed in binary code
(3) Port C: input port selection signal
(4) Port D: input expansion chip selection signal

The relationship between the port B output and the output mode is shown in Table 2-3-1, the block diagram

B_n	B_1	B_2	B_3	Output mode
0	0	0	0	PAUSE
1	0	0	0	F FWD
0	1	0	0	REW
1	1	0	0	——
1	1	1	0	PLAY, REC
0	0	0	1	EJECT
1	0	0	1	UNLOADING

Table 2-3-1

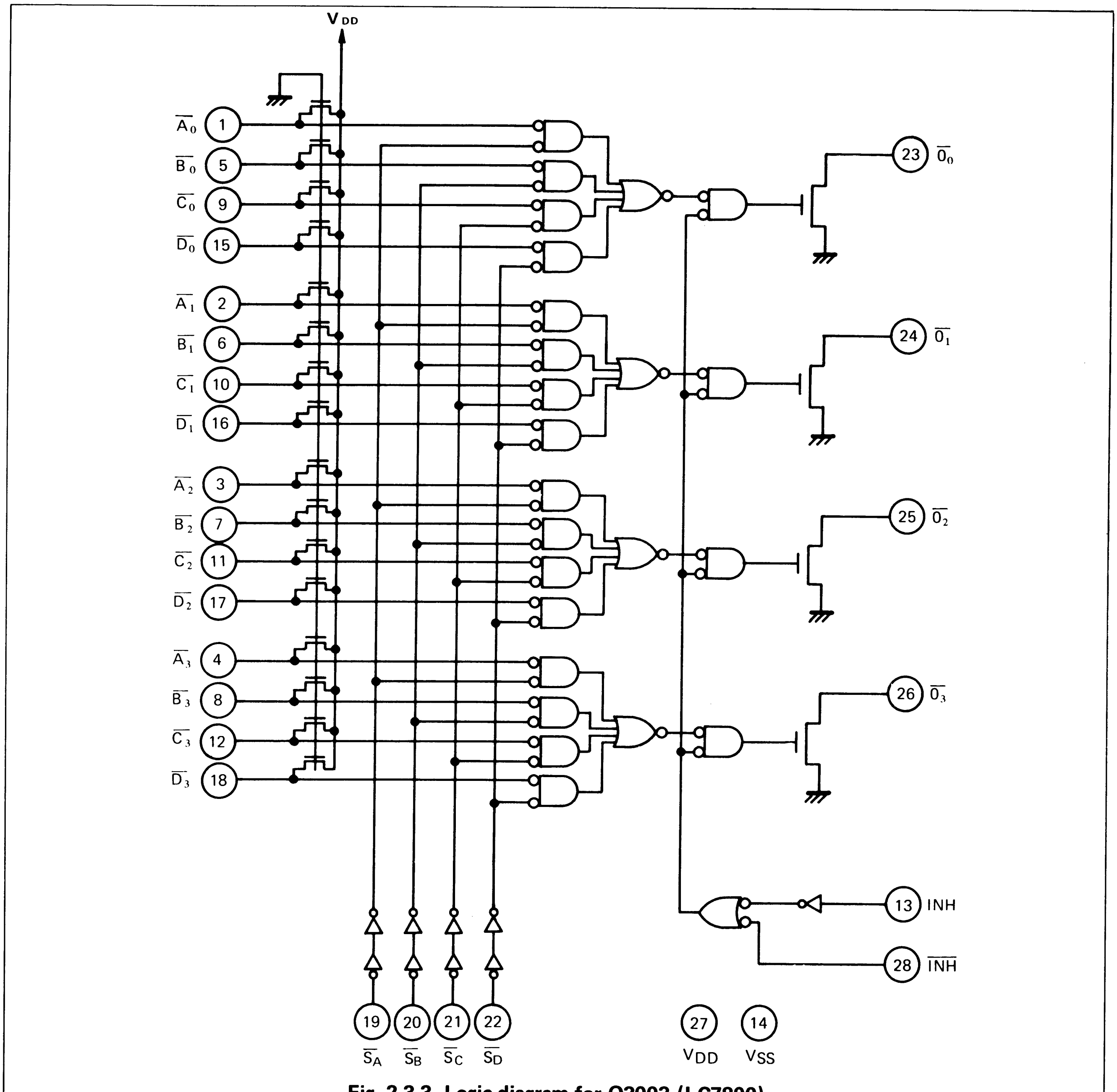

V DD
A̅0 1
B̅0 5
C̅0 9
D̅0 15
A̅1 2
B̅1 6
C̅1 10
D̅1 16
A̅2 3
B̅2 7
C̅2 11
D̅2 17
A̅3 4
B̅3 8
C̅3 12
D̅3 18
23 0̅0
24 0̅1
25 0̅2
26 0̅3
13 INH
28 I̅N̅H̅
19 20 21 22
S̅A S̅B S̅C S̅D
27 14
VDD VSS

Fig. 2-3-3 Logic diagram for Q3003 (LC7800)

for LM6402 (Q3001) is shown in Fig. 2-3-2, and the logic diagram for LC7800 (Q3002 and Q3003) is shown in Fig. 2-3-3.

LM6402 is a 4-bit, 1-chip microcomputer with a 2k-byte ROM and a 512-bit RAM, and its input/output ports consist of input/output combination ports A, B, C, D, G, H, and I, and input-only ports E and F. The input expander LC7800 is the chip for converting the 16 input signals A0 ~ D0, A1 ~ D1, A2 ~ D2, A3 ~ D3 into the 4-bit signals 00, 01, 02, and 03.

b. Input signals to the microcomputer

The input signals to the input expander LC7800 (Q3002 and Q3003) are shown in Table 2-3-2.

An explanation of each of the input signals is given below:

(1) Auto play switch

If this switch is ON [pin (1) of Q3002 is LOW] when either the end of the tape is reached or the tape counter reaches 9999 (if the memory switch is ON) while in the REW mode, the mode automatically will change to PLAY.

(2) Auto rewind switch

If the end of the tape is reached while in any one of the REC, PLAY, or F FWD modes, the mode will automatically change to REW.

(3) Erasure-prevention switch

If a cassette which is inserted has had its erasure-prevention tab removed, this switch will become OFF [pin (5) of Q3002 becomes HIGH].

(4) Inhibit switch

If this switch becomes ON [pin (6) of Q3002 becomes LOW], no input will be allowed from the REC, PLAY, or any of the other operation buttons (the normal state is HIGH).

(5) Lock selection switch

If this switch is ON [pin (7) of Q3002 is LOW], direct input from the REC button is possible. If this switch is OFF [pin (7) of Q3002 is HIGH], the mode will not change to REC unless the REC button is pressed within one second after pressing the LOCK button.

(6) Dew sensor

If dew forms, pin (9) of Q3002 will become LOW.

(7) Forward sensor

When the end of the tape is reached in the forward direction, pin (10) of Q3002 will become LOW.

(8) Rewind sensor

When the end of the tape is reached in the reverse direction, pin (11) of Q3002 will become LOW.

Input Ports	Input Pin No	Q3002 (LC7800)	Q3003 (LC7800)
A0	1	Auto play switch	LOCK button
A1	2	Auto rewind switch	————
A2	3	————	REC button
A3	4	————	EJECT button
B0	5	Erasure prevention switch	PAUSE button
B1	6	Inhibit switch	————
B2	7	Lock selection switch	————
B3	8	————	————
C0	9	DEW SENSOR	F FWD button
C1	10	FWD SENSOR	REW button
C2	11	REW SENSOR	STOP button
C3	12	REEL SENSOR	PLAY button
D0	15	CONTROL SIGNAL	EJECT button
D1	16	TIMER REC SIGNAL	Cassette switch
D2	17	REW STOP SIGNAL	————
D3	18	————	Loading switch

Table 2-3-2 Input signals to the microcomputer

Port	Pin no.	Output signal
D	D0 (8)	Input expander chip selection
	D1 (9)	Pinch roller solenoid activation
	D2 (10)	Fast forward/rewind solenoid activation
	D3 (11)	
E	E0 (12)	Video mute
	E1 (13)	Audio mute
	E2 (14)	$\overline{\text{REC EE}}$
	E3 (15)	$\overline{\text{STILL}}$ mode
F	F0 (16)	$\overline{\text{PAUSE LED}}$
	F1 (17)	$\overline{\text{REC LED}}$
	F2 (18)	
	F3 (19)	$\overline{\text{PLAY}}$ mode
G	G0 (22)	
	G1 (23)	$\overline{\text{REC}}$ mode
	G2 (24)	
	G3 (25)	
H	H0 (26)	$\overline{\text{HEAD MOTOR (MH)}}$
	H1 (27)	$\overline{\text{CAPSTAN MOTOR (MC)}}$
	H2 (28)	$\overline{\text{LOADING}}$ mode
	H3 (29)	$\overline{\text{REC PAUSE}}$
I	I0 (30)	$\overline{\text{REEL MOTOR}}$
	I1 (31)	Pinch roller solenoid hold
	I2 (32)	Fast forward/rewind solenoid hold
B	B0	
	B1 B2	Binary code output to the decoder (TC4028)
	B3	

Table 2-3-3 Output signals of Q3001

Port	Pin no.	Output signal
1	14	F FWD mode
2	2	REW mode
7	4	EJECT mode
8	9	UNLOADING mode

Table 2-3-4 Output signals of Q3004

(9) Reel sensor

If the rotation of the take-up reel base stops, pin (12) of Q3002 will become LOW.

(10) Control signal

If the control pulse from the tape ceases to be played back, a HIGH signal will be input to pin (15) of Q3002, and a video and audio mute signal will be output.

(11) Timer recording signal

During timer recording, a LOW signal will be input to pin (16) of Q3002.

(12) Rewind stop signal

If the number readout of the tape counter reaches 9999 while the memory switch is ON, a LOW signal will be input to pin (17) of Q3002. If this signal changes from HIGH to LOW during the REW mode, the mode of the VCR will change to STOP.

(13) Cassette switch

When a cassette is loaded, a LOW signal is input to pin (16) of Q3003.

(14) Loading switch

At the conclusion of loading, pin (18) of Q3003 becomes LOW.

c. Microcomputer output signals

The output signals of LM6402 (Q3001) and TC4028 (Q3004) are shown in Table 2-3-3 and Table 2-3-4, respectively.
The mode signals determined by the video muting, audio muting, and pinch-roller solenoid hold, and fast forward/rewind solenoid hold signals, and also by the binary signal of port B, are output at "high active".

d. Modes and output signals

The relationships of the output signals to the operation of the microcomputers in the principal modes are explained below:

(1) LOADING mode (Refer to Fig. 2-3-4.)

When a cassette is loaded, the cassette switch becomes ON, and the signal is transmitted to pin (16) of Q3003. The signal enters pin (34) of Q3001 from pin (24) of Q3003, and pin (26) of Q3001 becomes LOW. The signal of pin (26) passes through pins (5), (6) → (4) of Q3007, is transmitted to pin (1) of S3017, and then the MH-ON signal which causes the head motor to rotate is supplied to the servo circuit.
In addition, pin (28) and pin (30) of Q3001 become LOW, the signal passes through pins (6) → (9) → (5) → (10), (2) → (13) → (3) → (12) of Q3009, and then through Q3017, Q3018, Q3019 → Q3020, and a voltage of approximately 9 V is applied to the plus (+) terminal of the reel motor. The minus (-) terminal of the reel motor is earthed through Q3023, and the reel motor starts rotating in the forward direction.

(2) STOP mode (Refer to Fig. 2-3-5.)

When the STOP button is pressed, the STOP signal is input to pin (11) of Q3003. The signal enters pin (35) of Q3001 from pin (25) of Q3003, and pin (14) of Q3001 becomes LOW. The signal of pin (14) passes through pins (3) → (4) of Q3008, and the REC EE signal is supplied to the video circuit so that the mode changes to REC EE. By using this signal, the video circuit projects the EE monitor picture on the television screen.

(3) REC mode (Refer to Fig. 2-3-6.)

When the LOCK button is pressed, the LOCK signal passes through pins (1) → (23) of Q3003, and is input to pin (33) of Q3001. If the REC button is pressed within one second of this, the REC signal will pass through pins (3) → (25) of Q3003, be input to pin (35) of Q3001, and the mode will change to REC.
When the mode changes to REC:

(a) Pin (14) of Q3001 becomes LOW; this signal is reversed by pins (3) → (4) of Q3008, and the REC EE signal is supplied to the audio/video circuit.
(b) Pin (17) of Q3001 becomes LOW; and the LED which is connected to pin (7) of S3008 illuminates.
(c) Pin (23) of Q3001 becomes LOW; this signal is reversed by pins (1) → (2) of Q3008, and REC and PAUSE signals are supplied to the servo circuit and the video circuit.
(d) Pin (26) of Q3001 becomes LOW; this signal is inverted through pins (11) → (10) of Q3008, and the MH-ON signal which causes the head motor to rotate is supplied to pin (1) of S3017.
(e) Pin (27) of Q3001 becomes LOW; this signal is inberted through pins (13) → (12) of Q3008, and the MC-STD signal which causes the capstan motor to rotate is supplied to pin (2) of S3017.
(f) Pin (29) of Q3001 becomes LOW; this signal is inverted through pins (1), (2) → (3) of Q3007, and the REC PAUSE signal which controls the pause for timer recording is supplied to pin (2) of S3004.
(g) Pin (30) of Q3001 becomes LOW; this signal passes through pins (5) → (10) → (3) → (12) of Q3009, then through Q3017, Q3019 → Q3020, and the DC voltage necessary for approximately 1,000 rpm is applied to the plus (+) terminal of the reel motor. The minus (—) terminal is earthed through Q3023, and the reel motor starts rotating in the forward direction.
(h) Pin (31) of Q3001 becomes HIGH; this signal passes through pins (23) → (22) of Q3029, is amplified by Q3024, and then activates the pinch roller solenoid. After the pinch roller solenoid has been activated, the signal that passes through pin (22) of Q3029 is amplified by Q3025 and maintains the solenoid in the activated condition.

(4) PLAY mode (Refer to Fig. 2-3-7.)

When the PLAY button is pressed, the PLAY signal passes through pins (12) → (26) of Q3003, is input to pin (36) of Q3001, and the mode changes to PLAY.
When the mode changes to PLAY:

(a) Pin (12) and pin (13) of Q3001 become HIGH, and the VIDEO MUTE signal and the AUDIO MUTE signal are supplied to the video circuit and the audio circuit, respectively.
(b) Pin (19) of Q3001 becomes LOW and the PLAY LED, which is connected to pin (5) of S3008 to illuminate.
(c) Pin (26) of Q3001 becomes HIGH; this signal is inverted through pins (11) → (10) of Q3008, and the MH-ON signal is supplied to pin (1) of S3017.
(d) Pin (27) of Q3001 becomes LOW; this signal is inverted through pins (13) → (12) of Q3008, and the MC-ON signal is supplied to pin (2) of S3017.
(e) Pin (30) of Q3001 becomes LOW; this signal passes through pins (5) → (10) → (3) → (12) of Q3009 → Q3017, Q3019, Q3020, and the DC voltage necessary for approximately 1,000 rpm is applied to the plus (+) terminal of the reel motor. The minus (—) terminal is earthed through Q3023, and the reel motor starts rotating in the forward direction.
(f) Pin (31) of Q3001 becomes HIGH; this signal passes through pins (23) → D(22) of Q3029, is amplified by Q3024, and then activates the pinch roller solenoid. After the pinch roller solenoid has been activated, the signal that passes through pin (22) of Q3029 is amplified by Q3025 and maintains the solenoid in the activated condition.

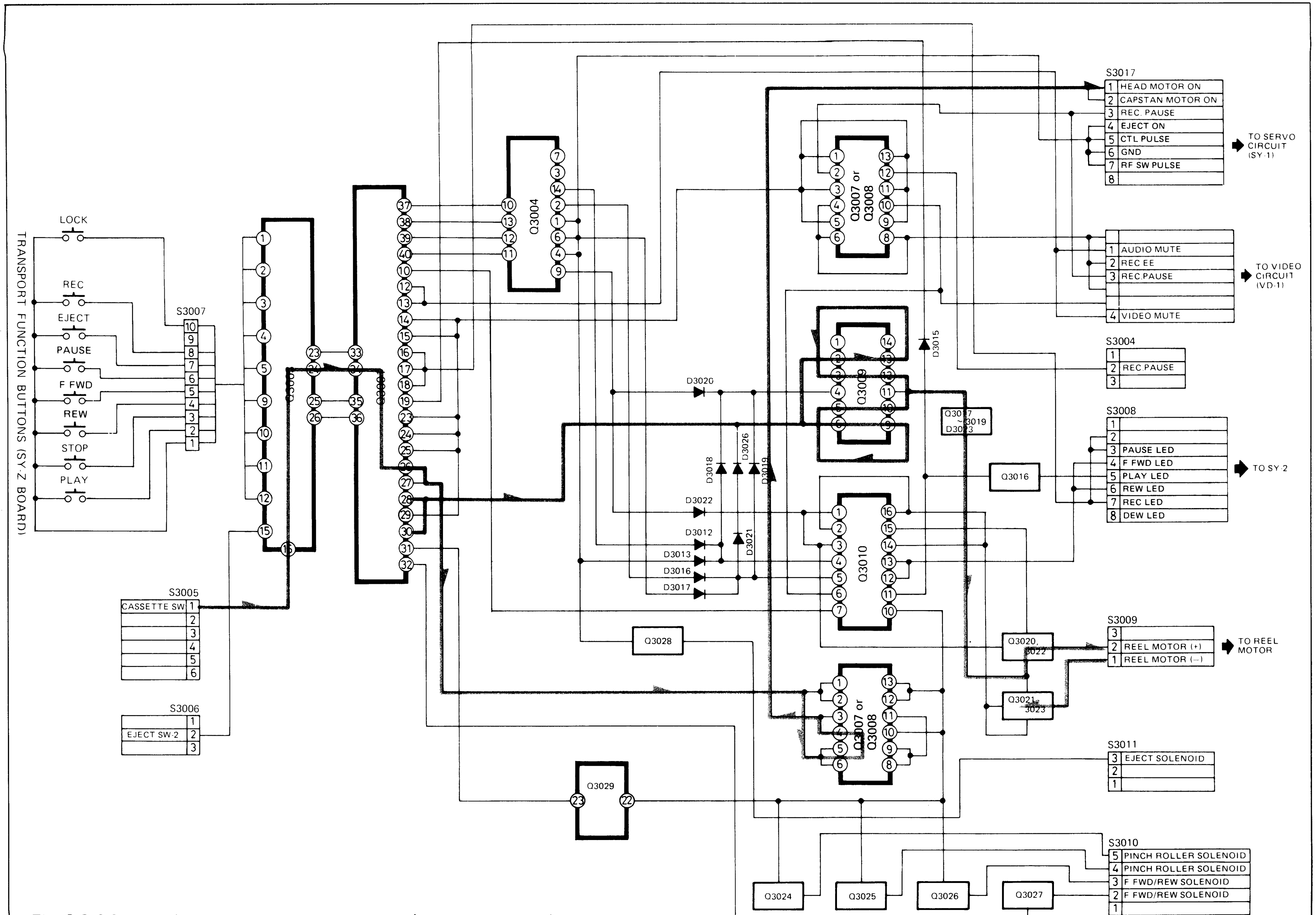

TRANSPORT FUNCTION BUTTONS (SY-Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW-2
Q3005
Q3006
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3028
Q3029
Q3016
Q3017 ~3019
D3023
Q3020, 3022
Q3021, 3023
Q3024
Q3025
Q3026
Q3027
D3015
D3018
D3019
D3020
D3021
D3022
D3026
D3012
D3013
D3016
D3017
S3017
HEAD MOTOR ON
CAPSTAN MOTOR ON
REC. PAUSE
EJECT ON
CTL PULSE
GND
RF SW PULSE
TO SERVO CIRCUIT (SY-1)
AUDIO MUTE
REC EE
REC.PAUSE
VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
REC PAUSE
S3008
PAUSE LED
F FWD LED
PLAY LED
REW LED
REC LED
DEW LED
TO SY-2
S3009
REEL MOTOR (+)
REEL MOTOR (−)
TO REEL MOTOR
S3011
EJECT SOLENOID
S3010
PINCH ROLLER SOLENOID
PINCH ROLLER SOLENOID
F FWD/REW SOLENOID
F FWD/REW SOLENOID

Fig. 2-3-4 System Control Circuit Block Diagram (LOADING mode)

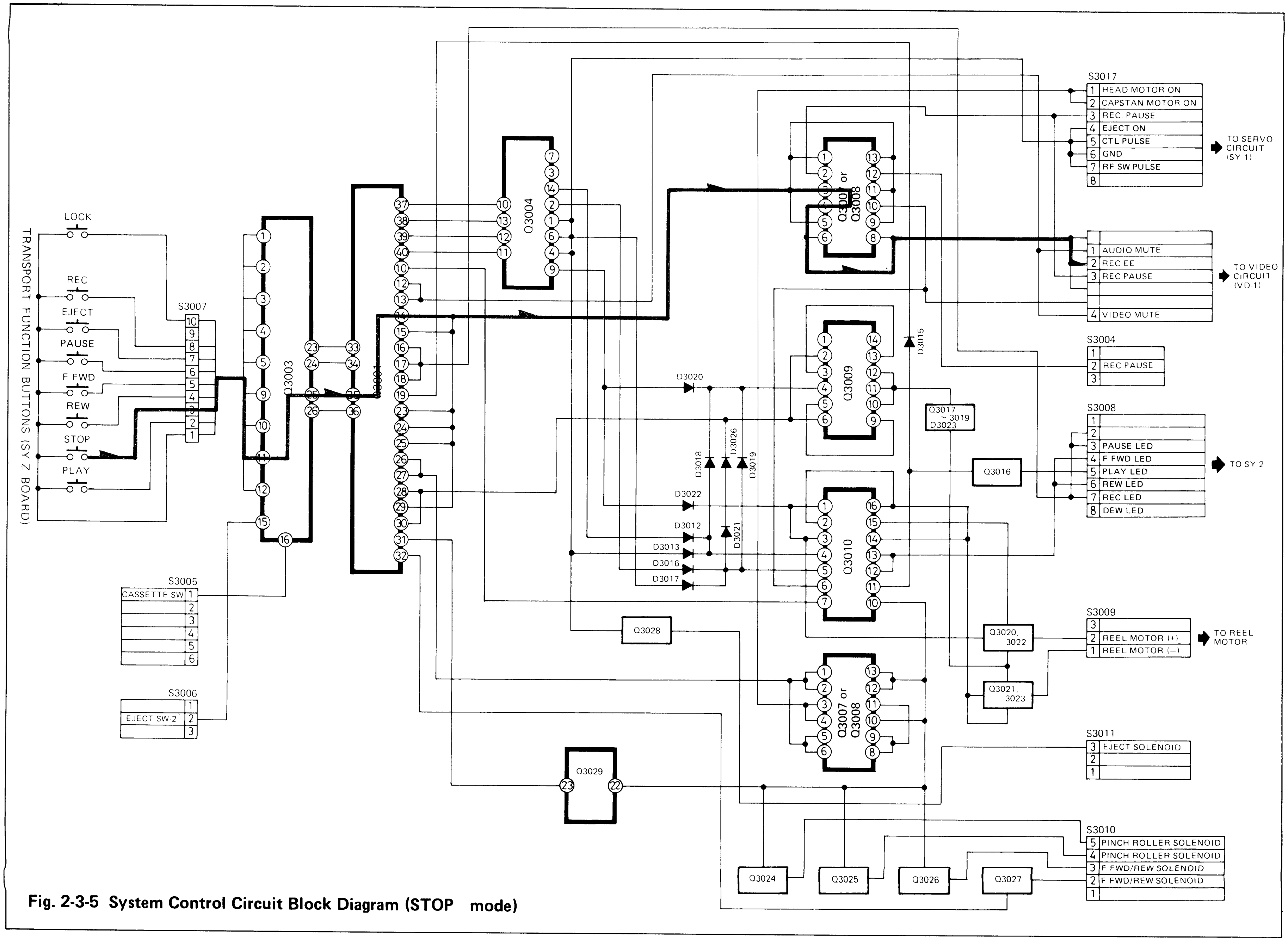

TRANSPORT FUNCTION BUTTONS (SY Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW-2
Q3003
Q3001
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3017 ~ 3019 D3023
Q3016
Q3020, 3022
Q3021, 3023
Q3028
Q3029
Q3024
Q3025
Q3026
Q3027
D3015
D3020
D3018
D3026
D3019
D3022
D3012
D3021
D3013
D3016
D3017
S3017
HEAD MOTOR ON
CAPSTAN MOTOR ON
REC. PAUSE
EJECT ON
CTL PULSE
GND
RF SW PULSE
TO SERVO CIRCUIT (SY-1)
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
REC.PAUSE
S3008
PAUSE LED
F FWD LED
PLAY LED
REW LED
REC LED
DEW LED
TO SY-2
S3009
REEL MOTOR (+)
REEL MOTOR (–)
TO REEL MOTOR
S3011
EJECT SOLENOID
S3010
PINCH ROLLER SOLENOID
PINCH ROLLER SOLENOID
F FWD/REW SOLENOID
F FWD/REW SOLENOID

Fig. 2-3-5 System Control Circuit Block Diagram (STOP mode)

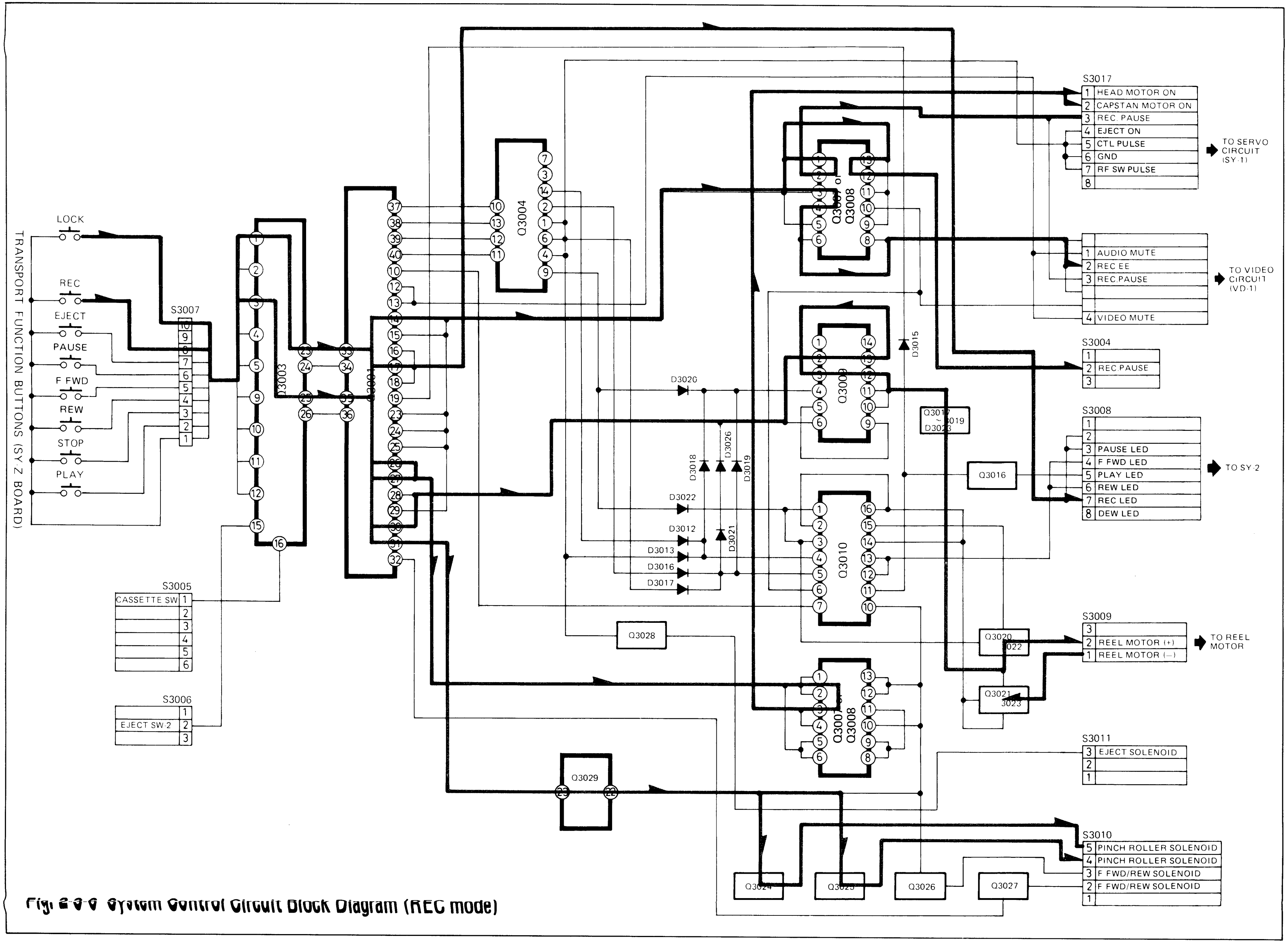

TRANSPORT FUNCTION BUTTONS (SY Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW 2
Q3003
Q3001
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3028
Q3029
Q3017 ~ Q3019 D3023
Q3016
Q3020 Q3022
Q3021 Q3023
Q3024
Q3025
Q3026
Q3027
D3015
D3020
D3026
D3018
D3019
D3022
D3012
D3021
D3013
D3016
D3017
S3017
1 HEAD MOTOR ON
2 CAPSTAN MOTOR ON
3 REC. PAUSE
4 EJECT ON
5 CTL PULSE
6 GND
7 RF SW PULSE
TO SERVO CIRCUIT (SY-1)
1 AUDIO MUTE
2 REC EE
3 REC PAUSE
4 VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
2 REC PAUSE
S3008
3 PAUSE LED
4 F FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED
TO SY-2
S3009
2 REEL MOTOR (+)
1 REEL MOTOR (–)
TO REEL MOTOR
S3011
3 EJECT SOLENOID
S3010
5 PINCH ROLLER SOLENOID
4 PINCH ROLLER SOLENOID
3 F FWD/REW SOLENOID
2 F FWD/REW SOLENOID

Fig. 2-3-6 System Control Circuit Block Diagram (REC mode)

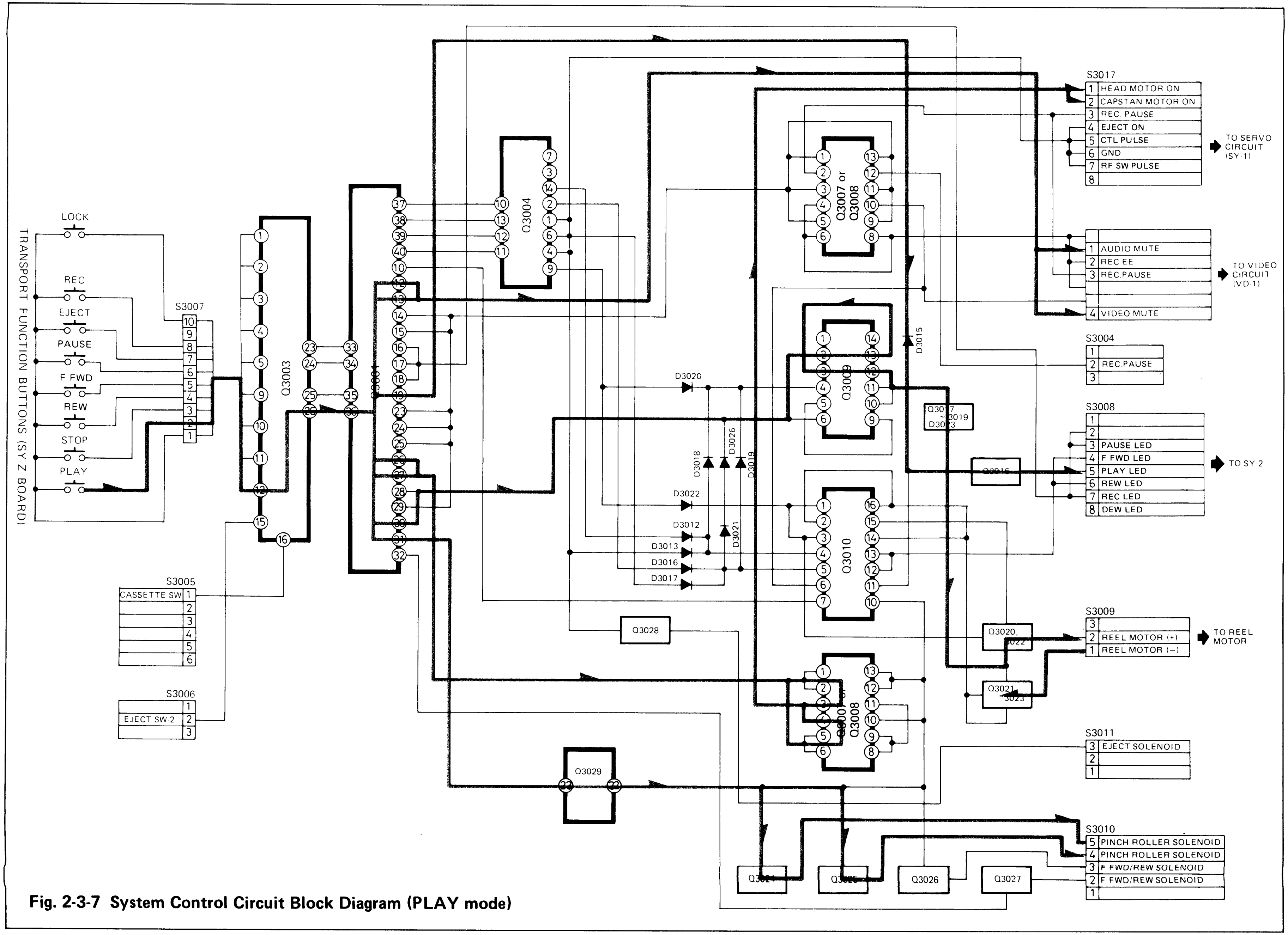

TRANSPORT FUNCTION BUTTONS (SY-2 BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW-2
Q3003
Q3001
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3007 or Q3008
Q3017 ~ Q3019
D3013
D3015
D3020
D3018
D3026
D3019
D3022
D3012
D3021
D3013
D3016
D3017
Q3016
Q3028
Q3029
Q3020, Q3022
Q3021, Q3023
Q3024
Q3025
Q3026
Q3027
S3017
1 HEAD MOTOR ON
2 CAPSTAN MOTOR ON
3 REC. PAUSE
4 EJECT ON
5 CTL PULSE
6 GND
7 RF SW PULSE
8
TO SERVO CIRCUIT (SY-1)
1 AUDIO MUTE
2 REC EE
3 REC PAUSE
4 VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
1
2 REC PAUSE
3
S3008
1
2
3 PAUSE LED
4 F FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED
TO SY-2
S3009
3
2 REEL MOTOR (+)
1 REEL MOTOR (−)
TO REEL MOTOR
S3011
3 EJECT SOLENOID
2
1
S3010
5 PINCH ROLLER SOLENOID
4 PINCH ROLLER SOLENOID
3 F FWD/REW SOLENOID
2 F FWD/REW SOLENOID
1

Fig. 2-3-7 System Control Circuit Block Diagram (PLAY mode)

(5) PAUSE mode (Refer to Fig. 2-3-8.)

If the PAUSE button is pressed during the REC mode, the mode will change to PAUSE. The PAUSE mode signal is input to pins (1) LOCK, (3) REC, and (5) PAUSE of Q3003, and the output of pin (23) and pin (26) of Q3003 is input to pin (33) and pin (36) of Q3001, respectively. When the mode changes to PAUSE:

(a) Pin (16) of Q3001 alternates between LOW and HIGH and this causes the PAUSE LED, which is connected to pin (3) of S3008, to blink on and off.
(b) Pin (17) of Q3001 becomes LOW, and the REC LED, which is connected to pin (7) of S3008, illuminates.
(c) Pin (23) of Q3001 becomes LOW; this signal is inverted by pins (1) → (2) of Q3008, and the REC and PAUSE signals are supplied to the servo circuit and the video circuit.
(d) Pin (26) of Q3001 becomes LOW; this signal is inverted through pins (5), (6) → (4) of Q3007, and the MH-ON signal is supplied to pin (1) of S3017.
(e) Pin (27) of Q3001 becomes LOW; this signal is inverted through pins (1), (2) → (3) of Q3007 and the MC-ON signal is supplied to pin (2) of S3017.
(f) Pin (30) of Q3001 becomes LOW; this signal passes through pins (2) → (13) → (3) → (12) of Q3009 → Q3017, Q3019, and Q3020, and the DC voltage is applied to the plus (+) terminal of the reel motor.

(6) F FWD mode (Refer to Fig. 2-3-9.)

If the F FWD button is pressed, the F FWD signal passes through pins (9) → (23) of Q3003, is input to pin (33) of Q3001, and the mode will change to F FWD.
When the mode changes to F FWD:

(a) Pin (10) of Q3001 becomes LOW; this signal is inverted by pins (7) → (10) of Q3010, switches Q3026 ON, and activates the F FWD/REW solenoid.
In addition, pin (32) of Q3001 becomes HIGH; this switches Q3027 ON, and maintains the fast forward/rewind solenoid in the activated condition.
(b) Pin (14) of Q3001 becomes LOW; this signal is inverted by pins (3) → (4) of Q3008, and the REC EE signal is supplied to the audio circuit and the video circuit.
(c) Pin (26) of Q3001 becomes LOW; this signal is inverted through pins (5), (6) → (4) of Q3007, and the MH-ON signal is supplied to pin (1) of S3017.
(d) Pin (30) of Q3001 becomes LOW; this signal passes through pins (2) → (13) → (3) → (12) of Q3009 → Q3017, Q3018 [regarding Q3018, pin (14) of Q3004 becomes HIGH, and Q3018 switches ON], Q3019, and Q3020, and the DC voltage necessary for approximately 4,000 rpm is applied to the plus (+) terminal of the reel motor. The minus (-) terminal is earthed through Q3023, and the reel motor starts rotating in the forward direction.
(e) Pin (14) of Q3004 becomes HIGH; this signal is inverted through D3012 → pins (4) → (13) of Q3010, and causes the F FWD LED, which is connected to pin (4) of S3008, to illuminate.

(7) REW mode (Refer to Fig. 2-3-10.)

If the REW button is pressed, the REW signal passes through pins (10) → (24) of Q3003, is input to pin (34) of Q3001, and the mode changes to REW.
When the mode changes to REW:

(a) Pin (10) of Q3001 becomes LOW; this signal is inverted by pins (7) → (10) of Q3010, switches Q3026 ON, and activates the fast forward/rewind solenoid.
In addition, pin (32) of Q3001 becomes HIGH; this switches Q3027 ON, and maintains the fast forward/rewind solenoid in the activated condition.
(b) Pin (14) of Q3001 becomes LOW; this signal is inverted by pins (3) → (4) of Q3008, and the REC EE signal is supplied to the audio circuit and the video circuit.
(c) Pin (26) of Q3001 becomes LOW; this signal is inverted through pins (5), (6) → (4) of Q3007, and the MH-ON signal is supplied to pin (1) of S3017.
(d) Pin (30) of Q3001 becomes LOW; this signal passes through pins (2) → (13) → (3) → (12) of Q3009 → Q3017, Q3018 [regarding Q3018, pin (2) of Q3004 becomes HIGH, and Q3018 switches ON], Q3019, and Q3021, and the DC voltage necessary for approximately 4,000 rpm is applied to the minus (-) terminal of the reel motor. The plus (+) terminal is earthed through Q3022, and the reel motor starts rotating in the reverse direction.
(e) Pin (2) of Q3004 becomes HIGH; this signal is inverted through D3016 → pins (5) → (12) of Q3010, and causes the REW LED, which is connected to pin (6) of S3008, to illuminate.

(8) UNLOADING mode (Refer to Fig. 2-3-11.)

If the EJECT button is pressed, the EJECT signal will pass through pins (4) → (23) of Q3003, and be input to pin (33) of Q3001.

(a) Pin (26) of Q3001 becomes LOW; this signal is inverted through pins (5), (6) → (4) of Q3007, and the MH-ON signal is supplied to pin (1) of S3017.
(b) Pin (4) of Q3004 becomes HIGH, this switches Q3028 ON, and maintains the EJECT solenoid in the activated condition.
(c) Pin (27) of Q3001 becomes LOW; this signal is inverted through pins (1), (2) → (3) of Q3007, and the MC-ON signal is supplied to pin (2) of S3017.
When the capstan motor starts to rotate, the eject lever becomes locked, and the eject switch becomes ON.

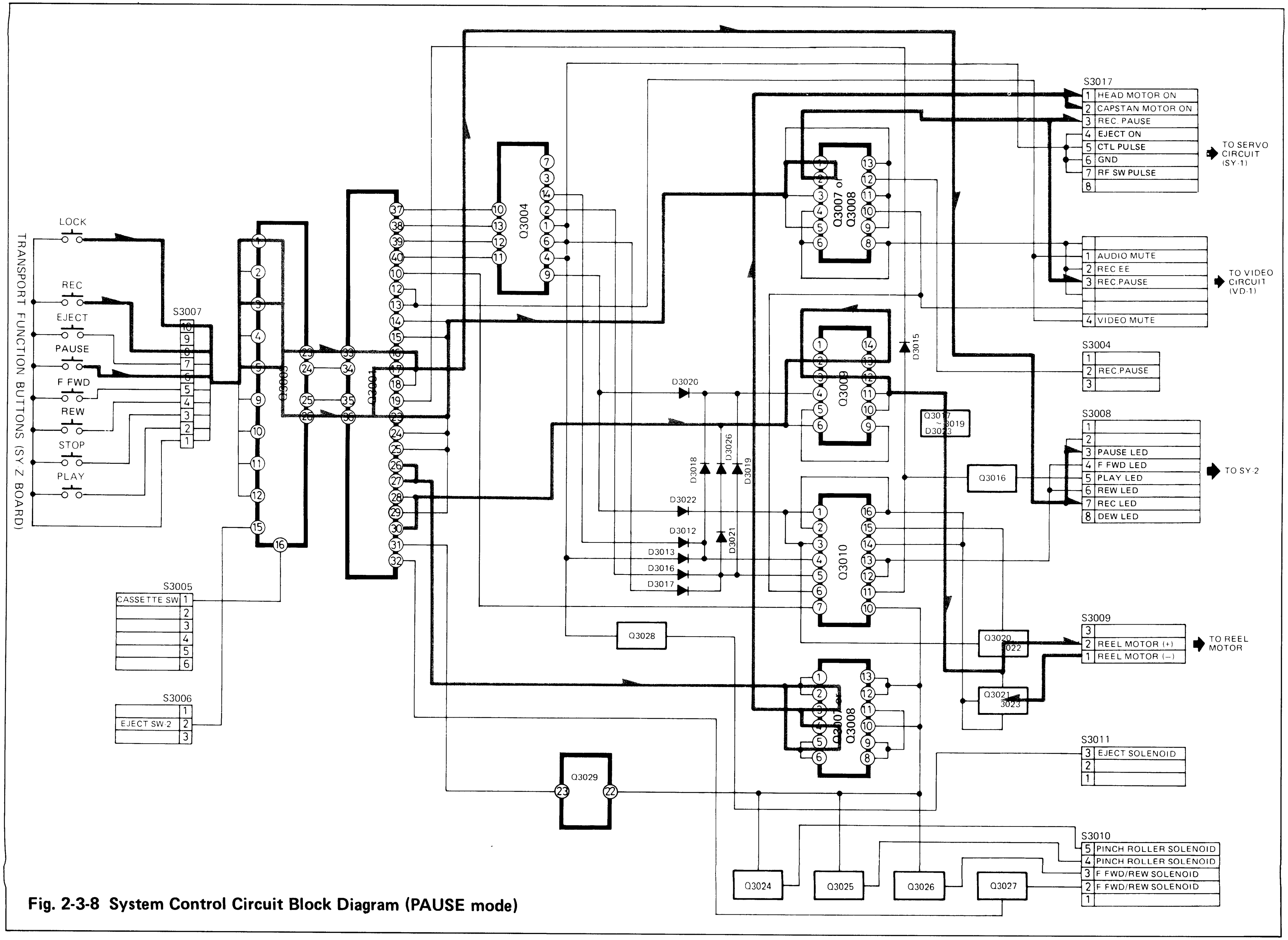

TRANSPORT FUNCTION BUTTONS (SY-Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
Q3003
Q3001
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3016
Q3017 ~ Q3019 D3023
Q3020 ~ 3022
Q3021 ~ 3023
Q3024
Q3025
Q3026
Q3027
Q3028
Q3029
D3015
D3020
D3018
D3026
D3019
D3022
D3012
D3021
D3013
D3016
D3017
S3005
CASSETTE SW
S3006
EJECT SW 2
S3017
HEAD MOTOR ON
CAPSTAN MOTOR ON
REC. PAUSE
EJECT ON
CTL PULSE
GND
RF SW PULSE
TO SERVO CIRCUIT (SY-1)
AUDIO MUTE
REC EE
REC.PAUSE
VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
REC PAUSE
S3008
PAUSE LED
F FWD LED
PLAY LED
REW LED
REC LED
DEW LED
TO SY-2
S3009
REEL MOTOR (+)
REEL MOTOR (−)
TO REEL MOTOR
S3011
EJECT SOLENOID
S3010
PINCH ROLLER SOLENOID
PINCH ROLLER SOLENOID
F FWD/REW SOLENOID
F FWD/REW SOLENOID

Fig. 2-3-8 System Control Circuit Block Diagram (PAUSE mode)

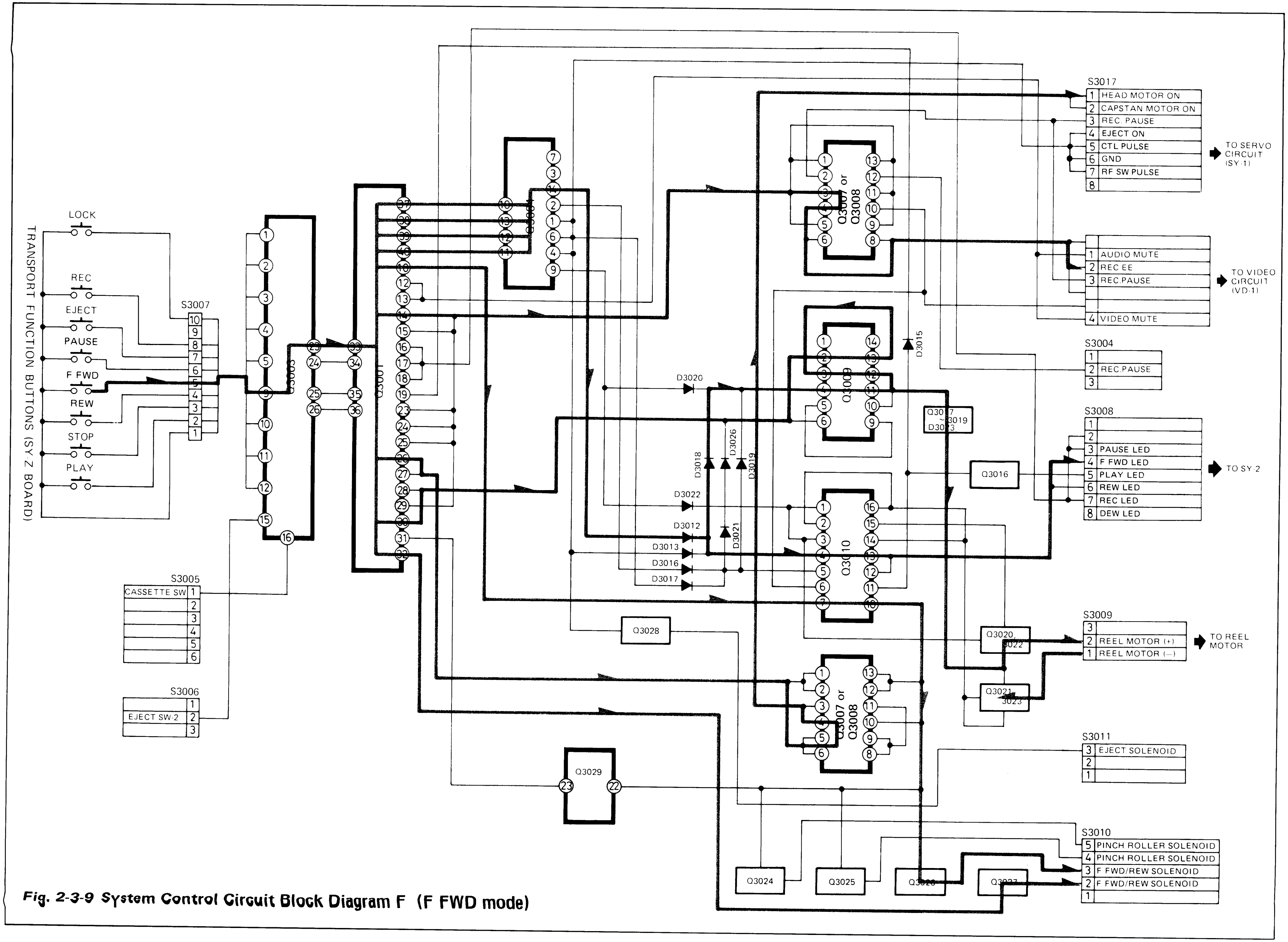
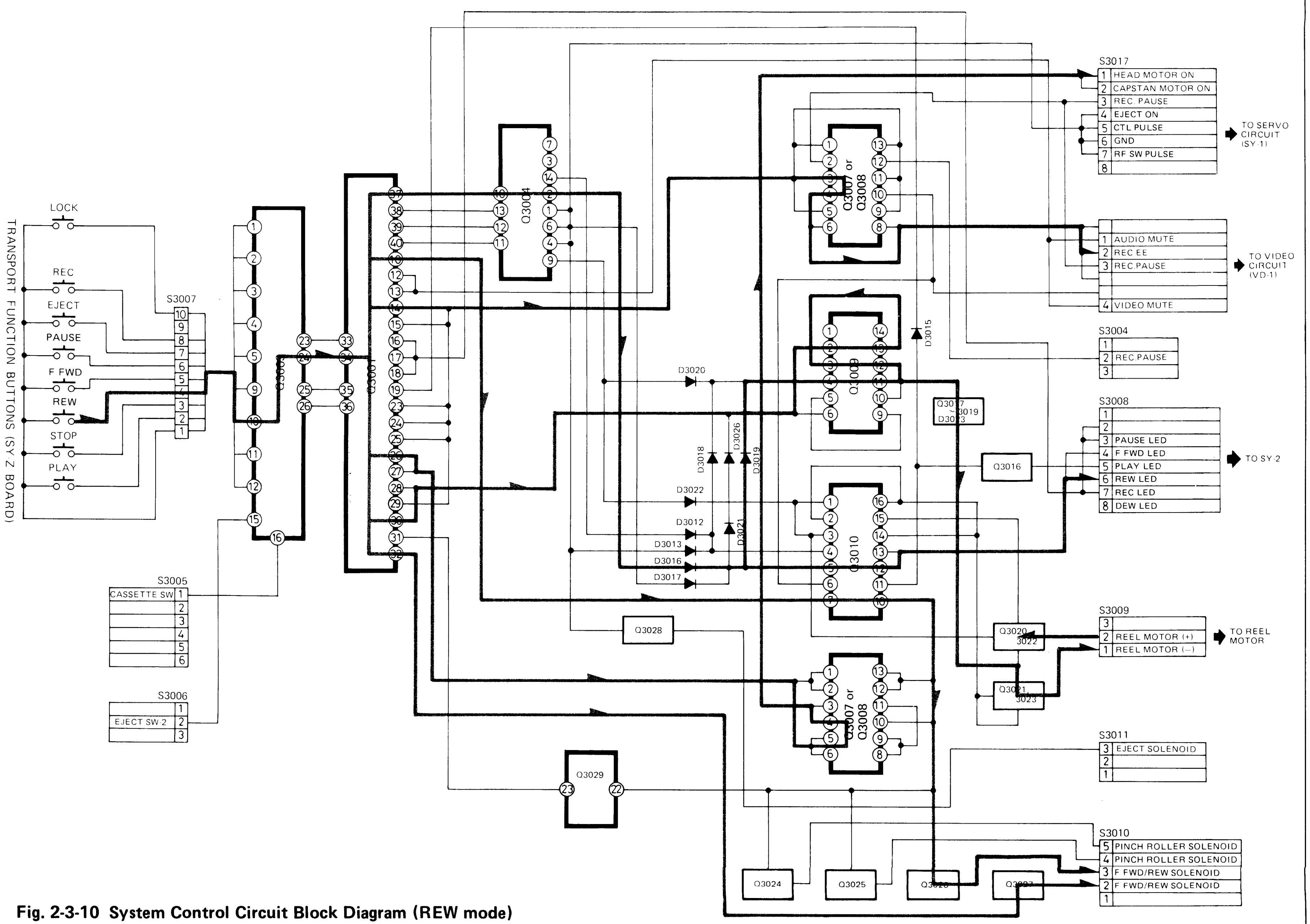

TRANSPORT FUNCTION BUTTONS (SY-Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW-2
Q3007 or Q3008
Q3009
Q3010
Q3028
Q3029
D3020
D3022
D3012
D3013
D3016
D3017
D3018
D3026
D3019
D3021
D3015
Q3017~Q3019 D3023
Q3016
Q3020, Q3022
Q3021, Q3023
Q3024
Q3025
Q3026
Q3027
S3017
1 HEAD MOTOR ON
2 CAPSTAN MOTOR ON
3 REC. PAUSE
4 EJECT ON
5 CTL PULSE
6 GND
7 RF SW PULSE
TO SERVO CIRCUIT (SY-1)
1 AUDIO MUTE
2 REC EE
3 REC.PAUSE
4 VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
2 REC.PAUSE
S3008
3 PAUSE LED
4 F FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED
TO SY-2
S3009
2 REEL MOTOR (+)
1 REEL MOTOR (−)
TO REEL MOTOR
S3011
3 EJECT SOLENOID
S3010
5 PINCH ROLLER SOLENOID
4 PINCH ROLLER SOLENOID
3 F FWD/REW SOLENOID
2 F FWD/REW SOLENOID

Fig. 2-3-9 System Control Circuit Block Diagram F (F FWD mode)



TRANSPORT FUNCTION BUTTONS (SY-Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
S3005
CASSETTE SW
S3006
EJECT SW 2
Q3002
Q3001
Q3004
Q3007 or Q3008
Q3009
Q3010
Q3029
Q3028
Q3016
Q3017 ~ 3019
D3023
Q3020 3022
Q3021 3023
Q3024
Q3025
Q3026
Q3027
D3015
D3020
D3018
D3026
D3019
D3022
D3012
D3021
D3013
D3016
D3017
S3017
HEAD MOTOR ON
CAPSTAN MOTOR ON
REC PAUSE
EJECT ON
CTL PULSE
GND
RF SW PULSE
TO SERVO CIRCUIT (SY-1)
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
REC PAUSE
S3008
PAUSE LED
F FWD LED
PLAY LED
REW LED
REC LED
DEW LED
TO SY-2
S3009
REEL MOTOR (+)
REEL MOTOR (−)
TO REEL MOTOR
S3011
EJECT SOLENOID
S3010
PINCH ROLLER SOLENOID
PINCH ROLLER SOLENOID
F FWD/REW SOLENOID
F FWD/REW SOLENOID

Fig. 2-3-10 System Control Circuit Block Diagram (REW mode)

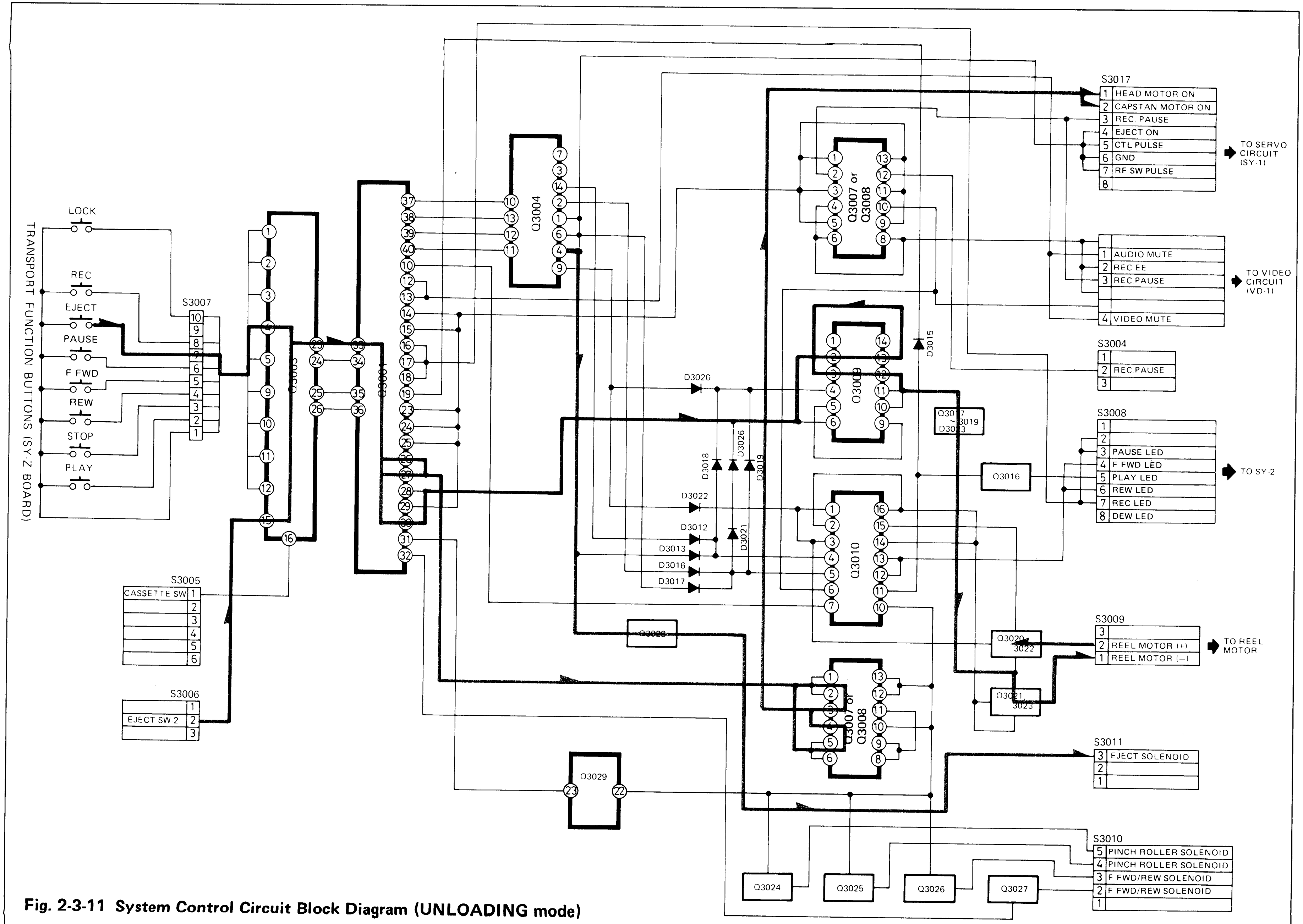

TRANSPORT FUNCTION BUTTONS (SY-Z BOARD)
LOCK
REC
EJECT
PAUSE
F FWD
REW
STOP
PLAY
S3007
10
9
8
7
6
5
4
3
2
1
Q3003
Q3001
Q3004
S3005
CASSETTE SW
S3006
EJECT SW-2
Q3028
Q3029
Q3007 or Q3008
Q3009
Q3010
D3020
D3022
D3012
D3013
D3016
D3017
D3018
D3026
D3019
D3021
D3015
Q3017 ~ 3019
D3023
Q3016
Q3020, 3022
Q3021, 3023
Q3024
Q3025
Q3026
Q3027
S3017
1 HEAD MOTOR ON
2 CAPSTAN MOTOR ON
3 REC. PAUSE
4 EJECT ON
5 CTL PULSE
6 GND
7 RF SW PULSE
8
TO SERVO CIRCUIT (SY-1)
1 AUDIO MUTE
2 REC EE
3 REC.PAUSE
4 VIDEO MUTE
TO VIDEO CIRCUIT (VD-1)
S3004
1
2 REC.PAUSE
3
S3008
1
2
3 PAUSE LED
4 F FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED
TO SY-2
S3009
3
2 REEL MOTOR (+)
1 REEL MOTOR (–)
TO REEL MOTOR
S3011
3 EJECT SOLENOID
2
1
S3010
5 PINCH ROLLER SOLENOID
4 PINCH ROLLER SOLENOID
3 F FWD/REW SOLENOID
2 F FWD/REW SOLENOID
1

Fig. 2-3-11 System Control Circuit Block Diagram (UNLOADING mode)

Output signal	Head motor	Capstan motor	Reel motor	Pinch roller solenoid	Fast forward/ rewind solenoid	Eject solenoid	LOADING mode	UNLOADING mode	REC-PAUSE mode	PLAY mode
Output pin no.	㉖ Q3001	㉗ Q3001	㉚ Q3001	㉛ Q3001	㉜ Q3001	④ Q3004	㉘ Q3001	⑨ Q3004	㉙ Q3001	⑦ Q3004
STOP mode										
REC, PLAY modes	1	1	A	B					1*	1
PAUSE mode	1		1	1						
F FWD mode	1		C		D					
REW mode	1		C		D					
LOADING mode	1		A				1			
UNLOADING mode	1		A					1		
CASSETTE UP mode										
EJECT mode	1	1				1				
Remarks									REC mode only	

A: After 0.1 second: "1"
(Remains in previous condition for 0.1 second)
B: After 0.2 second: "1"
(Remains in previous condition for 0.2 second)
C: After 0.7 second: "1"
D: After 0.5 second: "1"
E: After 0.2 second: "1"

The head motor, capstan motor, reel motor, LOADING mode, and REC PAUSE signals are all output as negative logic.

Table 2-3-5

Output signal	Capstan brake	REC mode	PLAY mode	PAUSE mode	F FWD mode	REW mode	PAUSE LED	REC LED	Video mute	Audio mute	REC EE mode
Output pin no.	㉒ Q3001	㉓ Q3001	⑲ Q3001	③ Q3004	⑭ Q3004	② Q3004	⑯ Q3001	⑰ Q3001	⑫ Q3001	⑬ Q3001	⑭ Q3001
EJECT mode											
STOP mode											1
REC mode		1						1*			
PLAY mode			1						1*	A	B
PAUSE mode		1		1			1*	1*			1
F FWD mode					1						1
REW mode						1					1
Remarks							Flashing at 1-second intervals	Flashing at 1-second intervals (LOCK switch "0")	If control signal is "1":"1"		

A: Audio mute

(1) 2 seconds after power supply begins: "1"
(2) 0.5 second after change from REC mode to PLAY mode and REC EE changes from "1" to "0": "1"
(3) If during PLAY mode, REC EE is "0", control signal is "1": "1"

B: REC EE mode

(1) 3 seconds after the beginning of forward movement and the LOADING mode when the mode has changed from STOP, F FWD, or REW to PLAY: "1"
(2) During LOADING mode

Except for the PAUSE mode, the FF mode, the REW mode, video muting, and audio muting, all output is done as negative logic.

Table 2-3-6

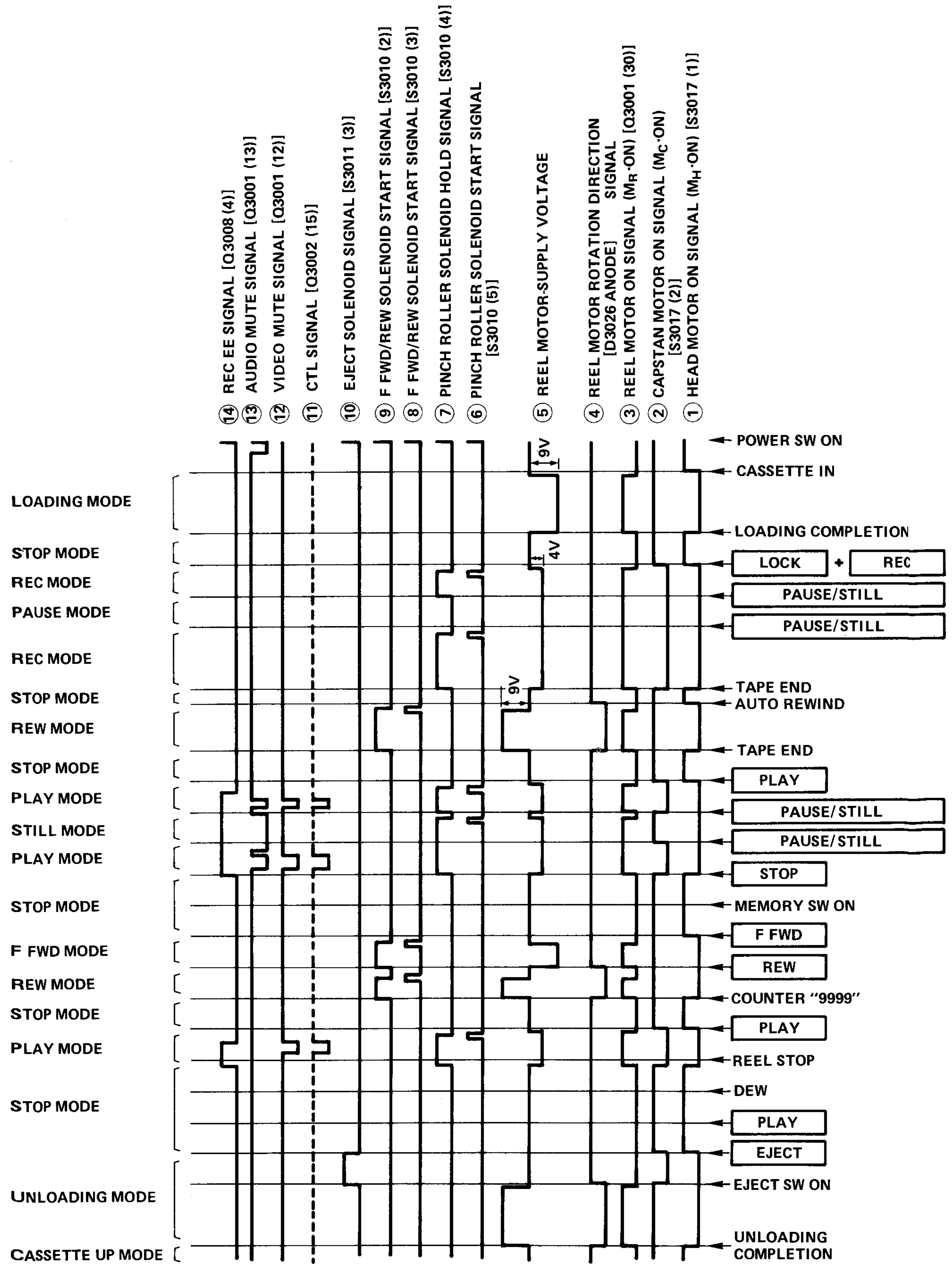

⑭ REC EE SIGNAL [Q3008 (4)]
⑬ AUDIO MUTE SIGNAL [Q3001 (13)]
⑫ VIDEO MUTE SIGNAL [Q3001 (12)]
⑪ CTL SIGNAL [Q3002 (15)]
⑩ EJECT SOLENOID SIGNAL [S3011 (3)]
⑨ F FWD/REW SOLENOID START SIGNAL [S3010 (2)]
⑧ F FWD/REW SOLENOID START SIGNAL [S3010 (3)]
⑦ PINCH ROLLER SOLENOID HOLD SIGNAL [S3010 (4)]
⑥ PINCH ROLLER SOLENOID START SIGNAL [S3010 (5)]
⑤ REEL MOTOR-SUPPLY VOLTAGE
④ REEL MOTOR ROTATION DIRECTION SIGNAL [D3026 ANODE]
③ REEL MOTOR ON SIGNAL (M_R·ON) [Q3001 (30)]
② CAPSTAN MOTOR ON SIGNAL (M_C·ON) [S3017 (2)]
① HEAD MOTOR ON SIGNAL (M_H·ON) [S3017 (1)]
9V
4V
9V
LOADING MODE
STOP MODE
REC MODE
PAUSE MODE
REC MODE
STOP MODE
REW MODE
STOP MODE
PLAY MODE
STILL MODE
PLAY MODE
STOP MODE
F FWD MODE
REW MODE
STOP MODE
PLAY MODE
STOP MODE
UNLOADING MODE
CASSETTE UP MODE
POWER SW ON
CASSETTE IN
LOADING COMPLETION
LOCK + REC
PAUSE/STILL
PAUSE/STILL
TAPE END
AUTO REWIND
TAPE END
PLAY
PAUSE/STILL
PAUSE/STILL
STOP
MEMORY SW ON
F FWD
REW
COUNTER "9999"
PLAY
REEL STOP
DEW
PLAY
EJECT
EJECT SW ON
UNLOADING COMPLETION

Fig. 2-3-12 Operation timing chart

(d) When the eject switch becomes ON, the mode changes to UNLOADING.

When the mode changes to UNLOADING:

(a) Pin (26) of Q3001 becomes LOW, and the MH-ON signal is supplied to pin (1) of S3017.

(b) Pin (30) of A3001 becomes LOW; this signal passes through pins (2) → (13) → (3) → (12) of Q3009 → Q3017, Q3018 [regarding Q3018, pin (9) of Q3004 becomes HIGH, and Q3018 switches ON], Q3019, Q3021, and approximately 9 V DC is applied to the minus (-) terminal of the reel motor. The plus (+) terminal is earthed through Q3022, the reel motor starts rotating in the reverse direction, and the loading ring rotates.

(c) Once unloading is completed, the cassette switch becomes OFF, and the cassette holder rises.

Each of the modes and the corresponding signals are shown in Table 2-3-5 and Table 2-3-6.

In addition, the operation timing chart is shown in Fig. 2-3-12.

2. Tape End Sensor Circuit

The tape end sensor circuit is shown in Fig. 2-3-13. The tape end sensor circuit consists of a sensor coil, a capacitor resonance circuit, and an operational amplifier oscillator circuit (during oscillation, the oscillation frequency is 200 kHz and the oscillation voltage is 0.3 Vp-p). The end of the tape is detected by using the dip of the Q of the sensor coil caused by the aluminium part of the tape.

Pin (14) of Q3005 becomes HIGH during the REW mode at the channel 1 (forward sensor) and channel 2 (rewind sensor) switching input terminal, and the switch is set to the reverse sensor.

When the tape is travelling in the reverse direction during the REW mode and the end of the tape is reached, oscillation will cease, the output [pin (13) of Q3005] will become LOW, pin (11) of the input expander LC7800 (Q3002) will become LOW, and the VCR will automatically stop.

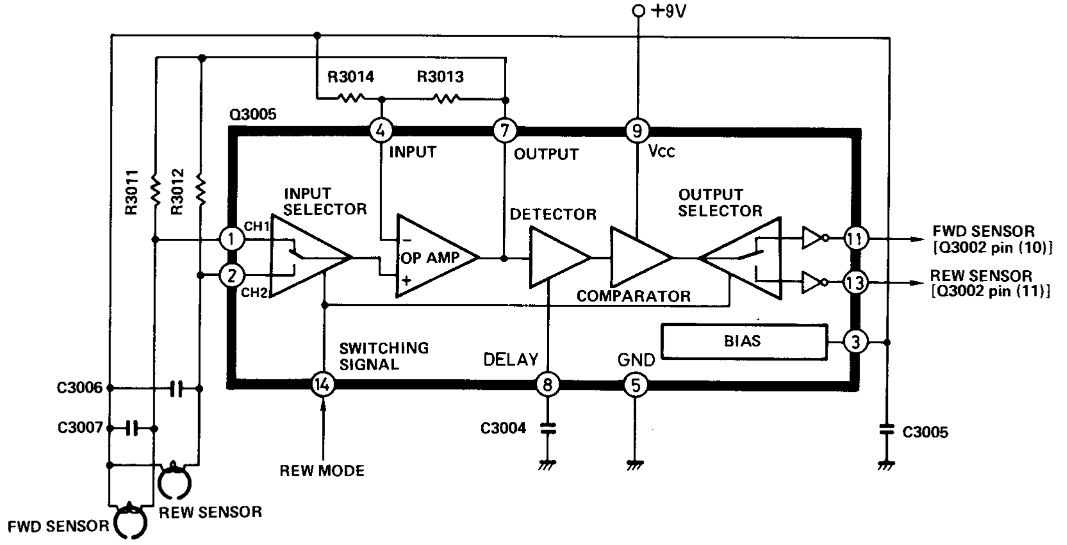


Fig. 2-3-13 Tape end sensor circuit

3. Sensor Circuits

The block diagram of the sensor circuits is shown in Fig. 2-3-14.

a. Dew circuit

The condensation (dew) condition of the VCR is detected by using a sensor whose resistance value varies according to humidity. The resistance value of the dew sensor is 1000 Megohms or more during dry times, and from 20 to 200 kilohms during condensation; therefore, if condensation occurs, the voltage of pin (10) of BA6135 (Q3006) will drop, both pin (9) and pin (9) of Q3003 will become LOW, and the VCR will automatically stop.

b. Reel base rotation sensor circuit

A signal from the reel base rotation detection mechanism (a ring-like magnet on the MC-1 circuit board), which consists of a magnet and a magnetic resistance element, is input to pin (12) of Q3006. If the reel base ceases rotation, C3010 will be charged through R3016, pin (14) of Q3006 and pin (12) of Q3002 will both become LOW, and the VCR will automatically stop.

c. Control pulse detection circuit

The reproduced control pulse normally is input to pin (4) of Q3006 from the servo circuit when a control pulse is not reproduced on the unrecorded parts of the tape; the signal ceases to be input to pin (4), C3011 is charged through R3017, pin (6) of Q3006 and pin (15) of Q3002 both become HIGH, and audio muting and video muting signals are output.

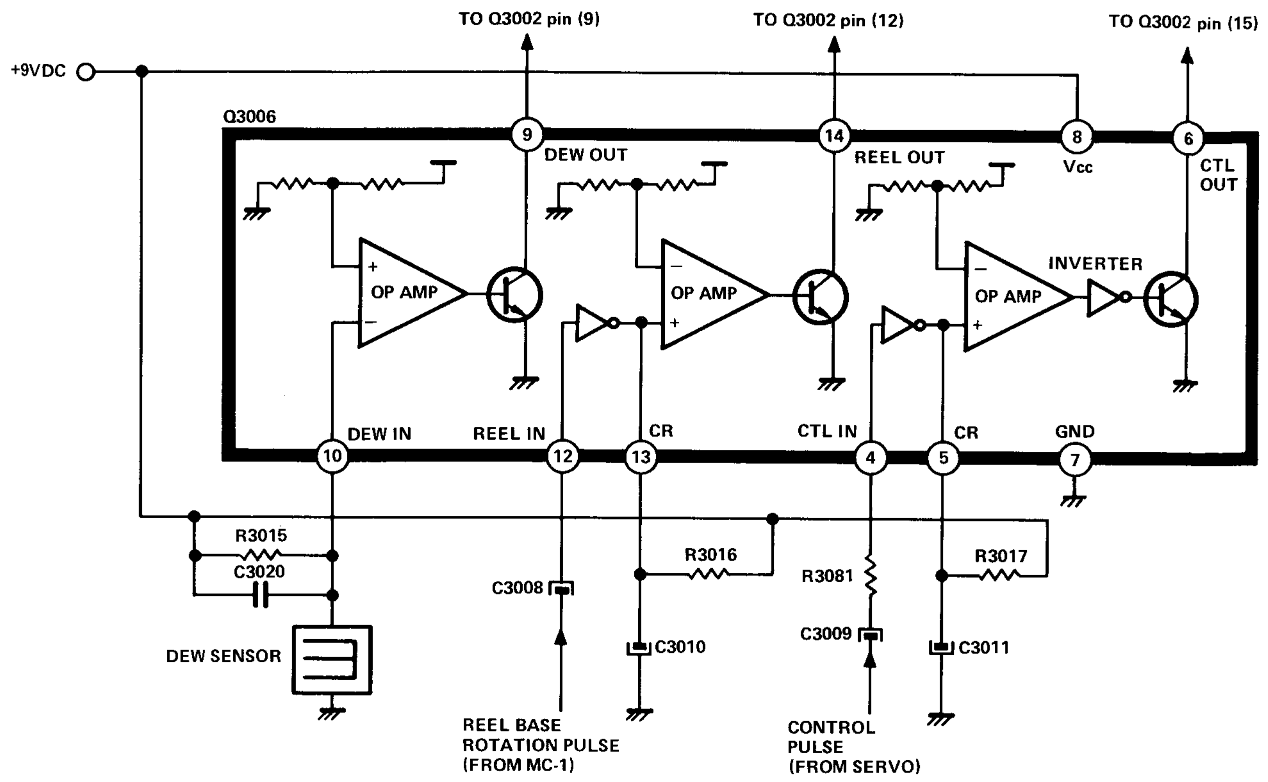

TO Q3002 pin (9)
TO Q3002 pin (12)
TO Q3002 pin (15)
+9VDC
Q3006
9
DEW OUT
14
REEL OUT
8
Vcc
6
CTL
OUT
OP AMP
+
−
OP AMP
−
+
INVERTER
OP AMP
−
+
DEW IN
REEL IN
CR
CTL IN
CR
GND
10
12
13
4
5
7
R3015
C3020
R3016
R3081
R3017
C3008
C3010
C3009
C3011
DEW SENSOR
REEL BASE
ROTATION PULSE
(FROM MC-1)
CONTROL
PULSE
(FROM SERVO)

Fig. 2-3-14 Sensor circuits

4. Solenoid Drive Circuitry

The pinch-roller solenoid drive circuit is shown in Fig. 2-3-15. If the PLAY button is pressed and the pinch-roller solenoid is activated, the pinch-roller solenoid activation signal [pin (9) of Q3001] will become HIGH for 150 milliseconds, transistor Q3024 will switch ON for the same period of time, and activation current will flow to the primary side winding of the pinch-roller solenoid. For the duration of pinch-roller solenoid hold, the pinch-roller solenoid hold signal [pin (22) of Q3029] is HIGH, transistor Q3025 is switched ON, and current will flow to both the primary winding and the secondary winding of the pinch-roller solenoid; thus accomplishing solenoid hold even after activation is finished. Using this type of drive system has made it possible to reduce the amount of electrical power consumed during holding.

Diodes D3006 and D3007 are the diodes for surge current absorption.

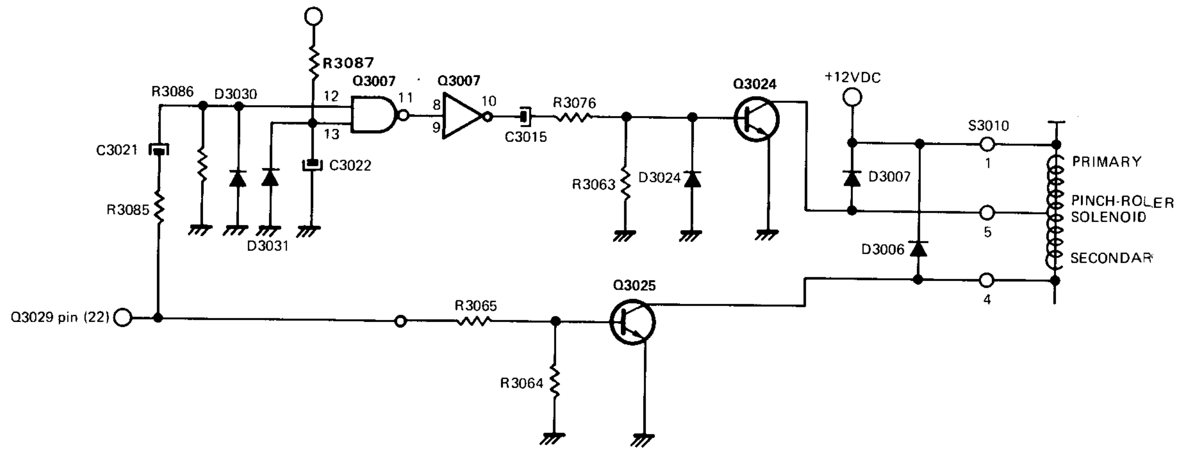

+9VDC
R3087
R3086
D3030
Q3007
Q3007
12
11
8
10
13
9
R3076
C3015
C3021
C3022
R3085
D3031
R3063
D3024
Q3024
+12VDC
S3010
1
D3007
5
D3006
4
PRIMARY
PINCH-ROLER
SOLENOID
SECONDAR
Q3025
R3065
Q3029 pin (22)
R3064

Fig. 2-3-15 Pinch-roller solenoid activation circuit

5. Reel Motor Drive Circuit

The reel motor drive circuit is shown in Fig. 2-3-16.

a. REC, PLAY, and PAUSE modes

The reel motor ON signal becomes LOW, Q3017 switches ON, and the voltage determined by R3051 and R3052 is supplied to the base of Q3019 through D3023. In addition, the current will flow in the following order: emitter of Q3019 → emitter of Q3020 → collector → reel motor → collector of Q3023 → emitter; and the reel motor will rotate in the forward direction at a speed of approximately 1,000 rpm.

b. F FWD and LOADING modes

Q3017 and Q3018 will both switch ON, and the collector voltage of Q3018 will be supplied to the base of Q3019. In addition, the current will flow in the following order: emitter of Q3019 → emitter of Q3020 → collector → reel motor → collector of Q3023 → emitter; and the reel motor will rotate in the forward direction at a speed of 4,000 rpm.

c. REW and UNLOADING modes

Q3017 and Q3018 will both switch ON, and the collector voltage of Q3018 will be supplied to the base of Q3019. In addition, the current will flow in the following order: emitter of Q3019 → emitter of Q3021 → collector → reel motor → collector of Q3022 → emitter; and the reel motor will rotate in the reverse direction at a speed of 4,000 rpm.

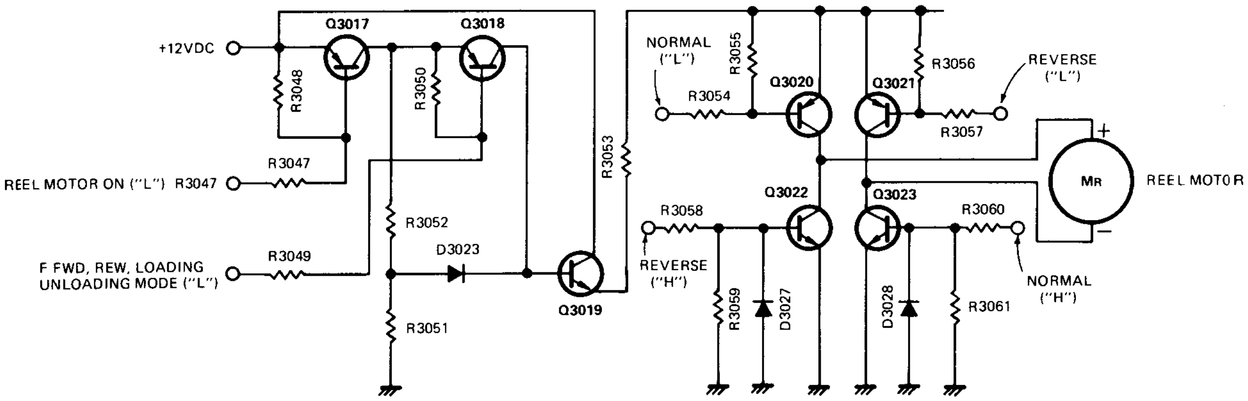

+12VDC
Q3017
Q3018
R3048
R3050
R3047
REEL MOTOR ON ("L") R3047
R3052
D3023
R3049
F FWD, REW, LOADING UNLOADING MODE ("L")
R3051
Q3019
R3053
NORMAL ("L")
R3055
R3054
Q3020
Q3021
R3056
REVERSE ("L")
R3057
+
MR
REEL MOTOR
−
Q3022
Q3023
R3058
REVERSE ("H")
R3060
NORMAL ("H")
R3059
D3027
D3028
R3061

Fig. 2-3-16 Reel motor drive circuit

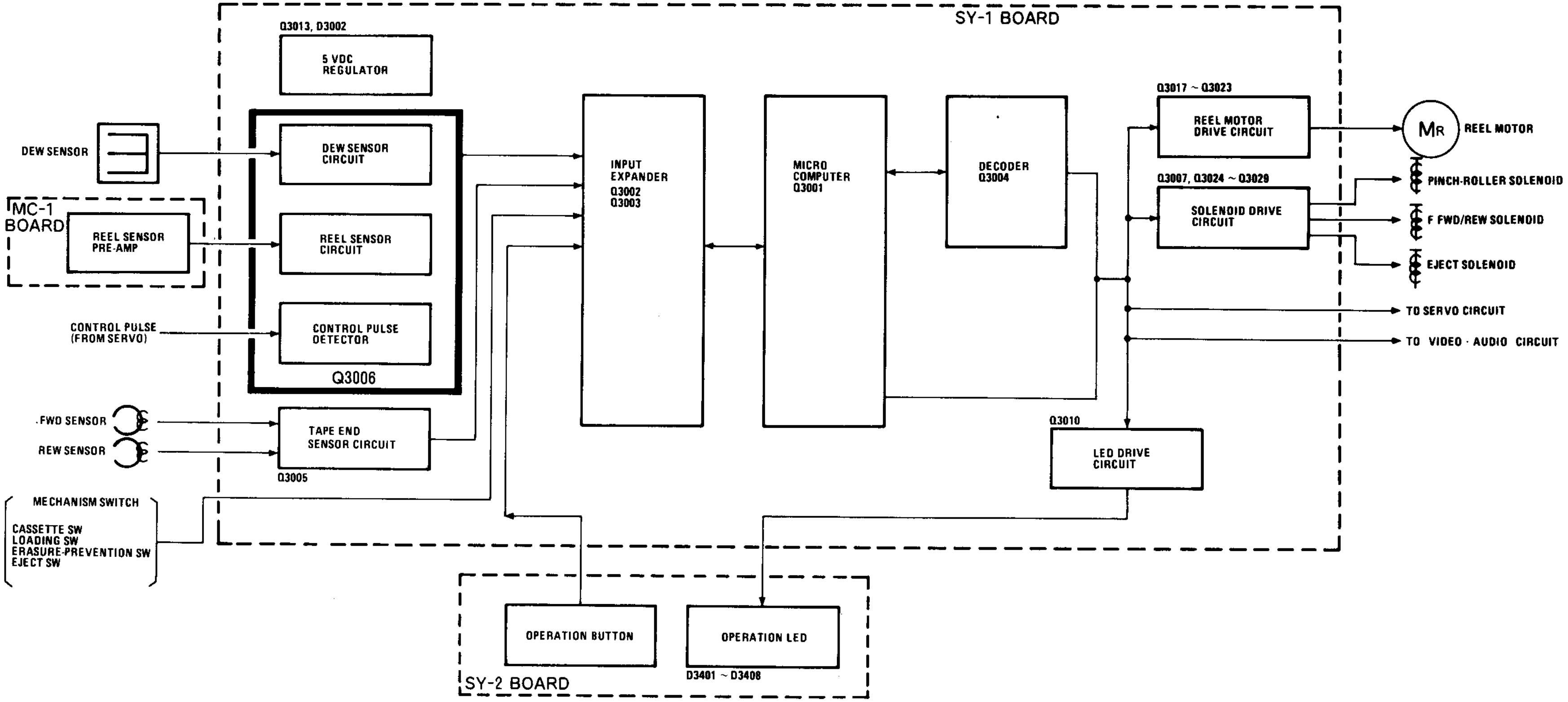

SY-1 BOARD
Q3013, D3002
5 VDC REGULATOR
DEW SENSOR
DEW SENSOR CIRCUIT
MC-1 BOARD
REEL SENSOR PRE-AMP
REEL SENSOR CIRCUIT
CONTROL PULSE (FROM SERVO)
CONTROL PULSE DETECTOR
Q3006
FWD SENSOR
REW SENSOR
TAPE END SENSOR CIRCUIT
Q3005
MECHANISM SWITCH
CASSETTE SW
LOADING SW
ERASURE-PREVENTION SW
EJECT SW
INPUT EXPANDER
Q3002
Q3003
MICRO COMPUTER
Q3001
DECODER
Q3004
Q3017 ~ Q3023
REEL MOTOR DRIVE CIRCUIT
MR
REEL MOTOR
Q3007, Q3024 ~ Q3029
SOLENOID DRIVE CIRCUIT
PINCH-ROLLER SOLENOID
F FWD/REW SOLENOID
EJECT SOLENOID
TO SERVO CIRCUIT
TO VIDEO · AUDIO CIRCUIT
Q3010
LED DRIVE CIRCUIT
OPERATION BUTTON
OPERATION LED
D3401 ~ D3408
SY-2 BOARD

Fig. 2-3-17 System control circuit block diagram

Button Previous mode	STOP	REC + LOCK	PLAY	PAUSE	F FWD	REW	EJECT
STOP	—	↓ REC	↓ PLAY	—	↓ F FWD	↓ REW	UNLOADING ↓ CASSETTE UP
REC	↓ STOP	—	↓ PLAY	↓ PAUSE	↓ F FWD	↓ REW	STOP ↓ UNLOADING ↓ CASSETTE UP
PLAY	↓ STOP	↓ REC	—	↓ STILL	↓ F SEARCH	STOP ↓ R SEARCH	STOP ↓ UNLOADING ↓ CASSETTE UP
PAUSE	↓ STOP	—	↓ STILL	↓ REC	↓ F FWD	↓ REW	STOP ↓ UNLOADING ↓ CASSETTE UP
F FWD	↓ STOP	STOP ↓ REC	STOP ↓ PLAY	—	—	STOP ↓ REW	STOP ↓ UNLOADING ↓ CASSETTE UP
REW	↓ STOP	STOP ↓ REC	STOP ↓ PLAY	—	STOP ↓ REW	—	STOP ↓ UNLOADING ↓ CASSETTE UP
CASSETTE UP	—	—	—	—	—	—	STOP ↓ UNLOADING ↓ CASSETTE UP
LOADING	LOADING ↓ STOP	LOADING ↓ STOP ↓ REC	LOADING ↓ STOP ↓ PLAY	—	LOADING ↓ F FWD	LOADING ↓ REW	STOP ↓ UNLOADING ↓ CASSETTE UP
UNLOADING	—	—	—	—	—	—	—

Table 2-3-8 Push button logic

V. AUDIO CIRCUIT

1. Outline

The audio circuit (AD-1 circuit board) combines the EQ-amplifier, microphone amplifier, recording amplifier, and the record/playback selection switch into a one-chip IC (Q2001) construction. A block diagram of the audio circuit is shown in Fig. 2-4-1.

2. EE Mode (Refer to Fig. 2-4-1.)

The audio signal input to terminal (1) of S2001 is input to pin (18) of Q2001 and, after being amplified by the microphone amplifier, is output from pin (4).

The signal output from pin (4) of Q2001 passes through the low pass filter, which is composed of L2003 and C2024, and is input to pin (9). After being amplified by the line amplifier, it is output from pin (10) of Q2001. This part is changed to direct current by the rectifier circuit and is input to pin (16) of Q2001. Pin (16) and pin (17) input a direct current to the base of the IC internal circuit which is connected to pin (16) of Q2001. The input of pin (18) is controlled in accordance with the control of the resistance variation between the collector of the IC internal circuit connected to pin (17) and earth.

The signal output to pin (10) of Q2001, after being adjusted by VR2002, is input to pin (12), passes through the recording amplifier, and is output from pin (13) of Q2001. In addition, the signal output from pin (13) of Q2001 acts as feedback according to the internal resistance of the IC, and also emphasizes the high frequencies according to the peaking circuit composed of L2002, R2012, and C2009. The signal output from pin (13) of Q2001 also passes through the bias trap composed of L2001 and C2015 and, when Q2002 and Q2003 are released (during recording), is supplied to the audio/control head as recording current.

3. REC Mode (Refer to Fig. 2-4-2.)

Other than in the EE mode, the oscillator circuit (which supplies the audio/control head with a bias current and supplies the audio erase head and the full erase head with an erasing current) operates, and, in conjunction with this, a recording current is supplied to the audio/control head. This is called the REC mode. REC + B is supplied from the video section, passes through R2038 and L2004, and causes oscillation. Simultaneously, Q2002, Q2003, and Q2005 are released by D2024.

4. PLAY Mode (Refer to Fig. 2-4-3.)

Play + B is supplied from the video section, and Q2008 operates. This releases Q2004, and also supplies high level voltage to pin (14) of Q2001. Fig. 2-4-4 shows the relationship between the voltage of pin (14) of Q2001 and each mode.

As shown in Fig. 2-4-4, muting is applied when the voltage of the EE mode, the REC mode, and the PLAY mode reaches approximately its halfway level. When the mute signal (approximately 9 V) from the system control circuit is input to terminal (5) of S2005, Q2010 is switched ON and muting is applied.

As mentioned previously, Q2004 is in a released condition. Therefore, when the signal from the audio/control head is input to pin (2) of Q2001, it is output to pin (4) of Q2001. This signal passes through R2021, C2021, VR2001, R2018, and C2018, applies negative feedback to pin (3) of Q2001, and composes the equalizer.

The signal output to pin (4) of Q2001 passes through the low pass filter just as during recording, and is input from VR2004 to pin (8); it then passes through the line amplifier, and is output to pin (10) of Q2001.

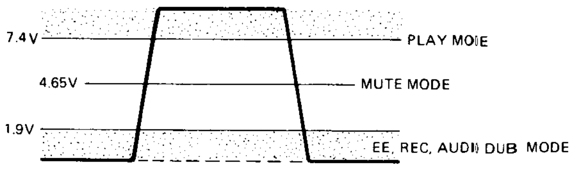


Fig. 2-4-4

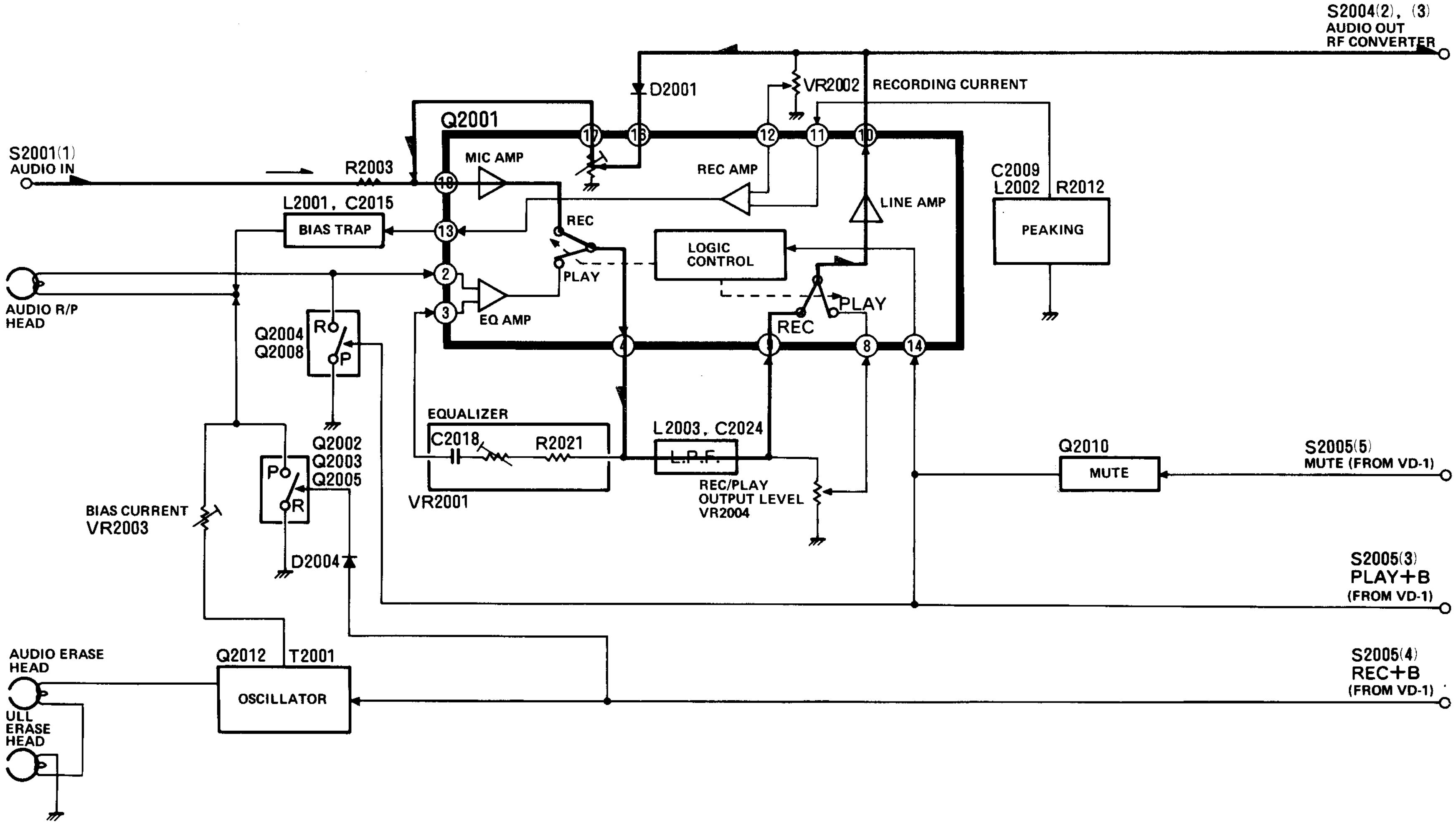

S2004(2), (3)
AUDIO OUT
RF CONVERTER
D2001
VR2002
RECORDING CURRENT
Q2001
S2001(1)
AUDIO IN
R2003
MIC AMP
REC AMP
C2009
L2002
R2012
L2001, C2015
BIAS TRAP
LINE AMP
REC
PEAKING
LOGIC
CONTROL
PLAY
AUDIO R/P
HEAD
EQ AMP
PLAY
REC
Q2004
Q2008
R
P
EQUALIZER
L2003, C2024
C2018
R2021
L.P.F.
Q2002
Q2003
Q2005
P
R
VR2001
REC/PLAY
OUTPUT LEVEL
VR2004
Q2010
MUTE
S2005(5)
MUTE (FROM VD-1)
BIAS CURRENT
VR2003
D2004
S2005(3)
PLAY+B
(FROM VD-1)
AUDIO ERASE
HEAD
Q2012
T2001
OSCILLATOR
S2005(4)
REC+B
(FROM VD-1)
ULL
ERASE
HEAD
2
3
4
8
9
10
11
12
13
14
16
17
18

Fig. 2-4-1 Audio Circuit Block Diagram (FF mode)

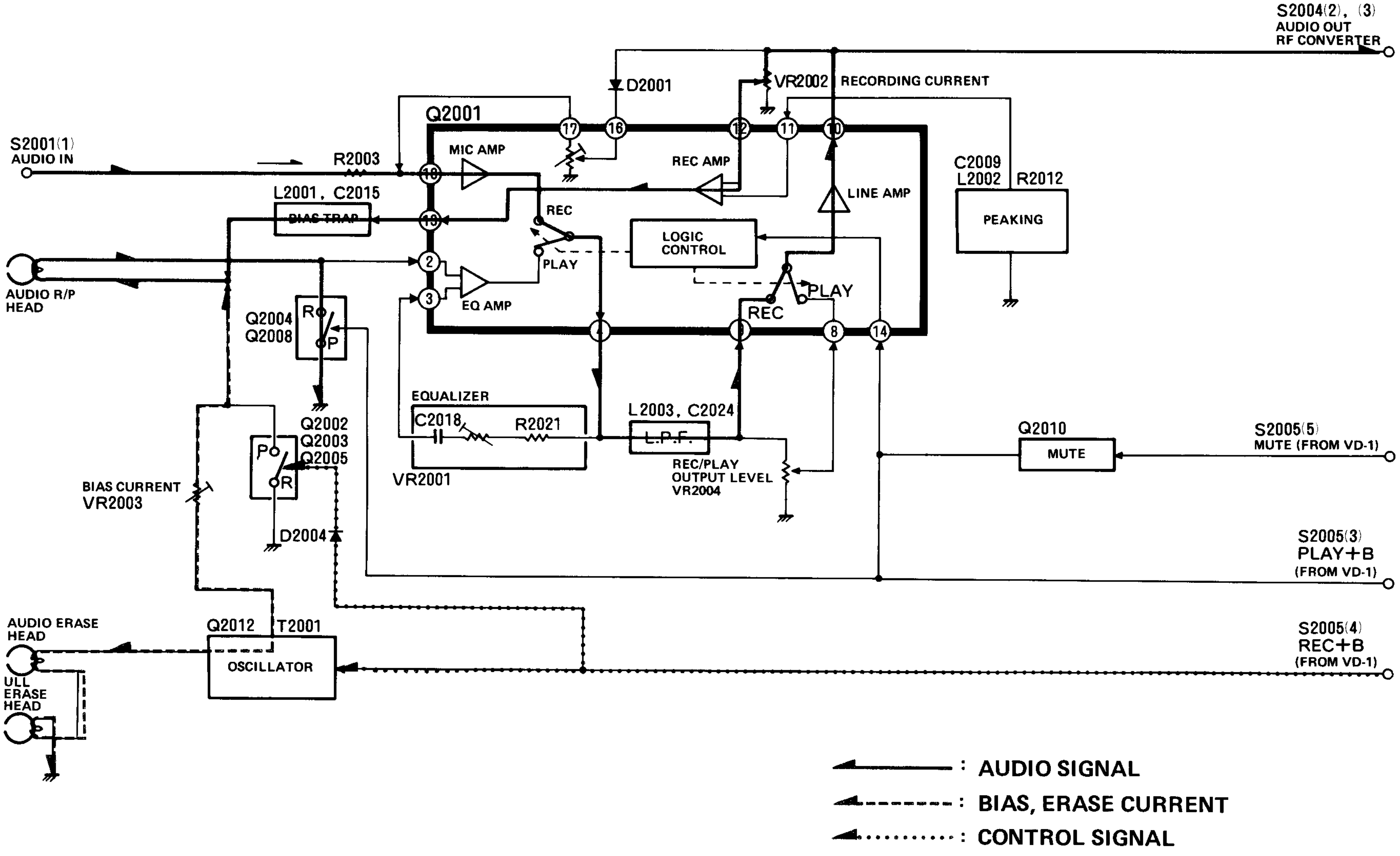

S2004(2), (3)
AUDIO OUT
RF CONVERTER
D2001
VR2002
RECORDING CURRENT
Q2001
S2001(1)
AUDIO IN
R2003
MIC AMP
REC AMP
C2009
L2002
R2012
L2001, C2015
BIAS TRAP
REC
LINE AMP
LOGIC CONTROL
PEAKING
PLAY
PLAY
REC
AUDIO R/P HEAD
EQ AMP
Q2004
Q2008
R
P
EQUALIZER
C2018
R2021
VR2001
L2003, C2024
L.P.F.
REC/PLAY OUTPUT LEVEL VR2004
Q2002
Q2003
Q2005
P
R
BIAS CURRENT
VR2003
D2004
Q2010
MUTE
S2005(5)
MUTE (FROM VD-1)
S2005(3)
PLAY+B
(FROM VD-1)
AUDIO ERASE HEAD
Q2012
T2001
OSCILLATOR
S2005(4)
REC+B
(FROM VD-1)
ULL ERASE HEAD
18
19
2
3
17
16
12
11
10
4
9
8
14
: AUDIO SIGNAL
: BIAS, ERASE CURRENT
: CONTROL SIGNAL

Fig. 2-4-2 Audio Circuit Block Diagram (REC mode)

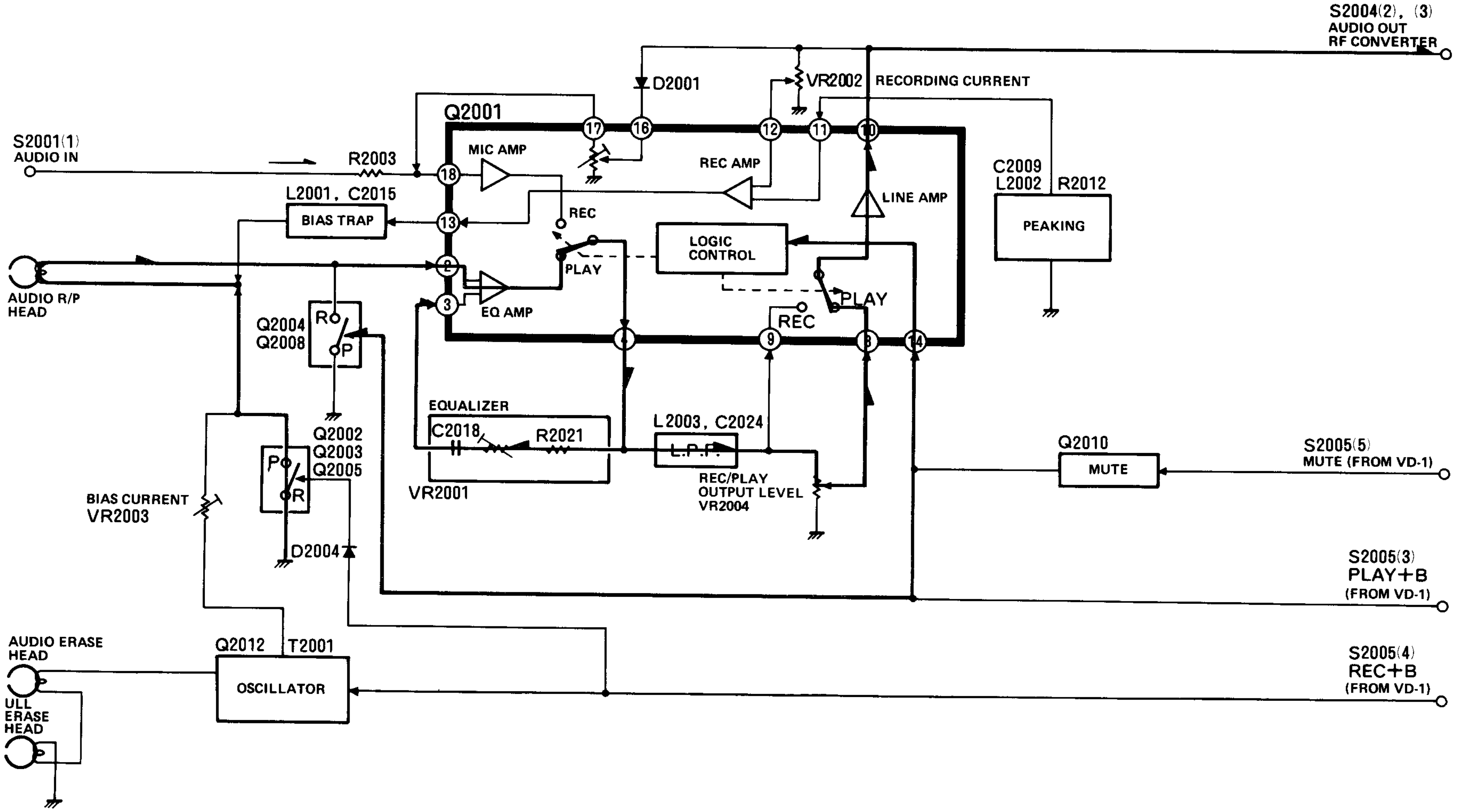

S2004(2), (3)
AUDIO OUT
RF CONVERTER
D2001
VR2002
RECORDING CURRENT
Q2001
S2001(1)
AUDIO IN
R2003
MIC AMP
17
16
12
11
10
18
REC AMP
C2009
L2002
R2012
L2001, C2015
BIAS TRAP
13
REC
LINE AMP
PEAKING
LOGIC CONTROL
2
PLAY
3
EQ AMP
PLAY
REC
AUDIO R/P HEAD
Q2004
Q2008
R
P
4
9
8
14
EQUALIZER
C2018
R2021
L2003, C2024
L.P.F.
Q2002
Q2003
Q2005
P
R
Q2010
MUTE
S2005(5)
MUTE (FROM VD-1)
BIAS CURRENT
VR2003
VR2001
REC/PLAY
OUTPUT LEVEL
VR2004
D2004
S2005(3)
PLAY+B
(FROM VD-1)
AUDIO ERASE HEAD
Q2012
T2001
OSCILLATOR
S2005(4)
REC+B
(FROM VD-1)
ULL ERASE HEAD

Fig. 2-4-3 Audio Circuit Block Diagram (PLAY mode)

VI. TIMER CIRCUIT

1. Outline

The timer circuit is mainly composed of a microcomputer. It contains, together with the timer function, a built-in one-programme per week recording function.

a. Timer function

The timer function is controlled by a power supply synchronous timer which utilizes a 50-Hz input as its clock frequency. The digital display flashes when power is first supplied to the VCR.

b. One programme per week function

It is possible to preset the starting time and the ending time for recording one programme up to one week in advance. It is also possible to record one programme automatically at the same time each day.
This timer circuit switches off the power to the VCR when the tape reaches its end regardless of the previously set ending time.

c. Digital display

The timer readout is indicated on an easy-to-read digital display. The digital display operates by a static type lighting system.

d. Setting the timer

The time can be adjusted and the timer can be set only while the POWER ON button is in the pressed position.

2. Circuit Structure

As is shown in Fig. 2-5-1, the timer circuit is mainly composed of a microcomputer, a fluorescent display, a key matrix circuit, an oscillation circuit, etc.

3. Timer Circuit Input/Output Signals

The signal from the system control circuit is input to the timer circuit along with the signals [the AC 2.4 V signal, the ALLWAY + 15 V signal, the TIMER (T/S) + 15 V signal (only when the timer button is pressed), and the REC PAUSE signal (only during recording)] which are input from the power supply circuit. Also, a TIMER OUT signal and a REW STOP signal are output from the timer circuit to the system control circuit (SY-1 circuit board), and a TIMER OUT signal is output from the timer circuit to the power supply circuit.

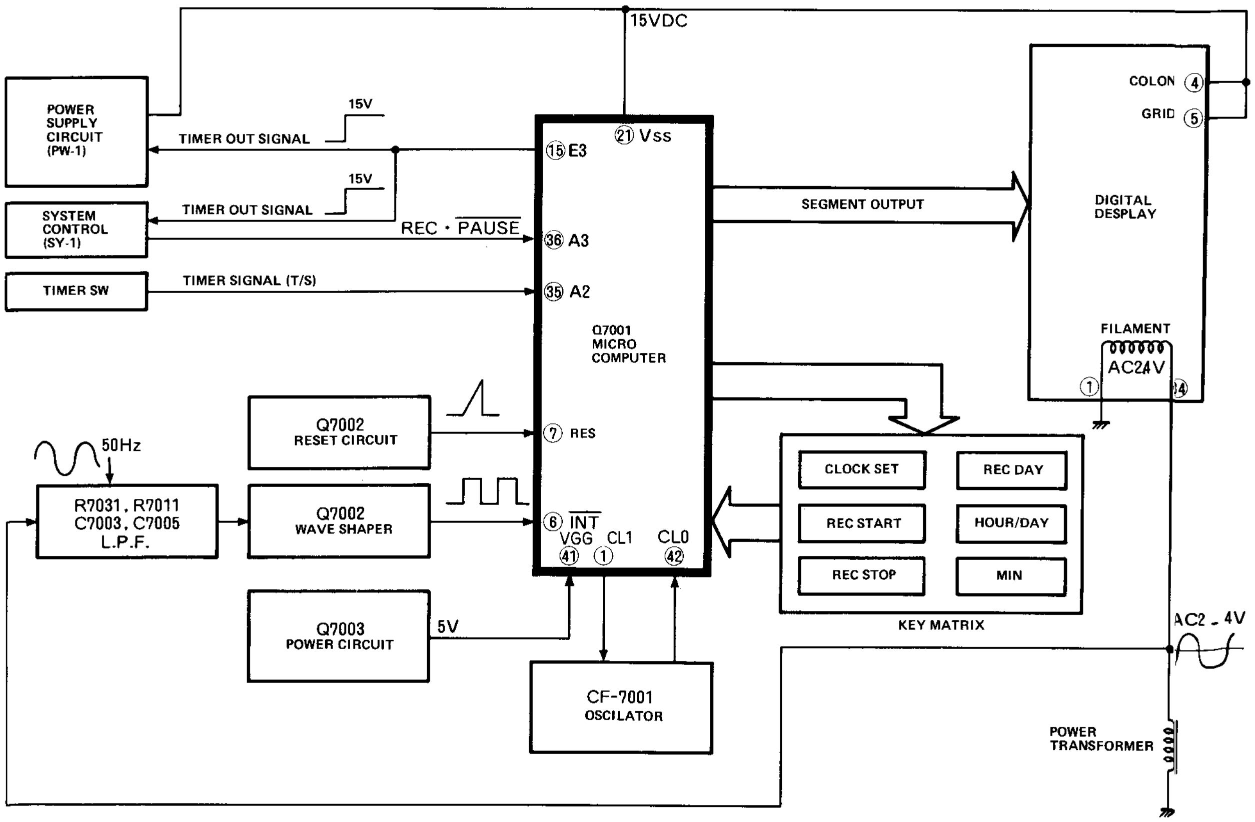

15VDC
POWER SUPPLY CIRCUIT (PW-1)
15V
TIMER OUT SIGNAL
SYSTEM CONTROL (SY-1)
15V
TIMER OUT SIGNAL
REC · PAUSE
TIMER SW
TIMER SIGNAL (T/S)
⑮ E3
㉑ Vss
㊱ A3
㉟ A2
Q7001 MICRO COMPUTER
⑦ RES
⑥ INT
VGG CL1 CLO
㊶ ① ㊷
SEGMENT OUTPUT
COLON ④
GRID ⑤
DIGITAL DESPLAY
FILAMENT
AC2.4V
①
⑭
50Hz
R7031, R7011 C7003, C7005 L.P.F.
Q7002 RESET CIRCUIT
Q7002 WAVE SHAPER
Q7003 POWER CIRCUIT
5V
CF-7001 OSCILATOR
CLOCK SET
REC DAY
REC START
HOUR/DAY
REC STOP
MIN
KEY MATRIX
AC2.4V
POWER TRANSFORMER

Fig. 2-5-1 Timer circuit block diagram

4. Current Time Display

The current time is indicated on the fluorescent display. This indication occurs when the clock pulse (50 Hz) which is applied to pin (6) of Q7001 is converted into segment output by Q7001, and then output from pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32) of Q7001 to pin (6) ~ pin (33) of the fluorescent display.

a. AC 2.4 V is applied to terminal (2) of timer circuit S7001 from terminal (2) of power supply circuit S7003.

b. The noise component in the AC power line is eliminated at the clock input circuit by the low-pass filter, which is composed of R7013, C7003, R7011, and C7005. The AC 2.4 V is then input to pin (6) of Q7002.

c. After the sine wave from which the noise component has been eliminated is shaped into a short waveform by the waveform shaping circuit (Q7002), it is input as the clock pulse to pin (6) of Q7001.

d. The clock pulse input as a short waveform is counted by the microcomputer (Q7001). Each time this count reaches 50, the time is memorized inside the microcomputer as constituting one second.

e. When the seconds memory of the microcomputer reaches 60, +1 is recorded in the minutes memory. In the same way, when the minutes memory reaches 60, +1 is recorded in the hours memory.

f. At the rate of once every 3 milliseconds, the microcomputer converts the data in the minutes memory and the hours memory into a segment signal for the fluorescent display, and outputs this to pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32) of Q7001. This output results in the current time indication on the fluorescent display.

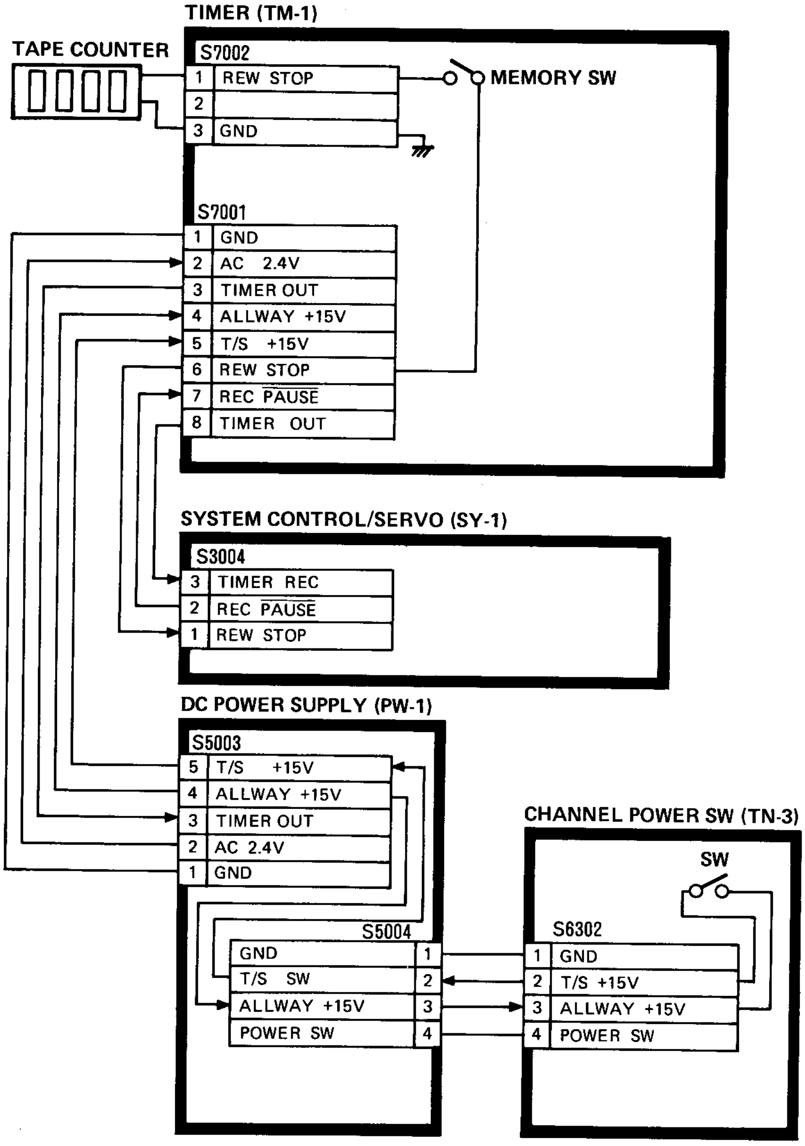

TIMER (TM-1)
TAPE COUNTER
0000
S7002
1 REW STOP
2
3 GND
MEMORY SW
S7001
1 GND
2 AC 2.4V
3 TIMER OUT
4 ALLWAY +15V
5 T/S +15V
6 REW STOP
7 REC PAUSE
8 TIMER OUT
SYSTEM CONTROL/SERVO (SY-1)
S3004
3 TIMER REC
2 REC PAUSE
1 REW STOP
DC POWER SUPPLY (PW-1)
S5003
5 T/S +15V
4 ALLWAY +15V
3 TIMER OUT
2 AC 2.4V
1 GND
S5004
GND 1
T/S SW 2
ALLWAY +15V 3
POWER SW 4
CHANNEL POWER SW (TN-3)
SW
S6302
1 GND
2 T/S +15V
3 ALLWAY +15V
4 POWER SW

Fig. 2-5-2 Block diagram of timer unit signals

5. Time Display

When the respective button is pressed, the time indication (starting time for recording, ending time for recording, and the day of the week) of the timer is indicated on the fluorescent display. In order to produce this indication, the times (e.g., the starting time for recording) in the memory of the microcomputer are converted to a segment output by the microcomputer, and output from pin (2) ~ pin (11), pin (16) ~ pin (19), pin (22), and pin (23) of Q7001 to pin (6) ~ pin (33) of the fluorescent display.

a. As shown in Fig. 2-5-3, when the REC START button (SW7003) is pressed, the key scan signal from the key maxtrix circuit is input to the microcomputer (Q7001).

b. When the microcomputer determines that the REC START button (SW7003) has been pressed, it retrieves the starting time for recording from its internal memory, and outputs it to the fluorescent display.

c. If the MIN button (SW7007) is pressed while the REC START button is being pressed, a signal is input to the microcomputer in the same manner described previously, and the output from pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32), of Q7001 is changed, advancing the minute indication one minute. The minute indication advances in this manner each time the minute button is pressed.

d. After the minutes have been changed as described in item c above, releasing the MIN button and then releasing the REC START button will cause the microcomputer to memorize the time output from pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32) of Q7001 as the starting time for recording. The ending time for recording and the day of the week are also memorized in the same way.

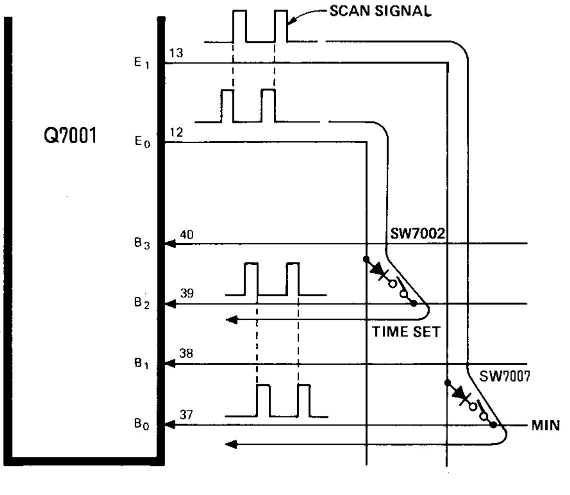


Fig. 2-5-3

6. Timer-Controlled Recording

When the starting time for recording is reached, timer-controlled recording begins. Then, when either the ending time for recording or the end of the tape is reached, timer-controlled recording is canceled, and the power supply is switched to a standby condition.

a. Timer-controlled recording can be done only when the TIMER button is in the pressed position. Also, when the TIMER button is in the pressed position, terminal (5) of S7001 becomes +15 V, which switches Q7005 ON, and causes pin (35) of Q7001 to become V_{GG} (+5 V) level.

b. If the conditions described in item 1 above have been satisfied, the timer out signal will be output from pin (15) of Q7001 when the starting time for recording is reached (when the day of the week is either d:I or d:E).

c. The timer out signal which is output from terminal (15) of Q7001 is output to the system control circuit (SY-1 circuit board) from terminal (8) of S7001 and to the power supply circuit from terminal (3) of S7001.

d. When the VCR enters the REC mode, a REC PAUSE signal (+9 V) is input from terminal (2) of S7004 in the system control circuit (SY-1 circuit board) to terminal (7) of S7001 in the timer circuit.

e. The REC PAUSE signal which is input to terminal (7) of S7001 passes through R7024 and is input to the base of Q7006. Q7006 then switches ON, and the collector of Q7006 becomes earth potential. Also, because R7031 is connected to earth and to the base of Q7007, Q7007 also switches ON, and pin (36) of Q7001 becomes V_{GG} (+5 V) level.

f. When the REC PAUSE signal is input, the microcomputer (Q7001) determines that the VCR is performing timer-controlled recording normally, and it continues to output a timer out signal until the ending time for recording is reached.

g. When the ending time for recording is reached, the timer out signal from pin (15) of Q7001 is switched OFF. The timer out signal from terminal (3) and from terminal (8) of S7001 ceases to be output, and the VCR is switched to a standby condition.

h. When the tape comes to its end, the system control circuit (SY-1 circuit board) stops inputting the REC PAUSE signal to terminal (7) of S7001, and, as a result, Q7006 and Q7007 are switched OFF, and pin (36) of Q7001 becomes V_{SS} (+15 V) level.

i. When pin (35) of Q7001 becomes V_{SS} (+15 V) level, the microcomputer determines that the tape has reached its end, and it switches off the timer out signal which is output from pin (15) of Q7001. The timer out signal from terminal (3) and terminal (8) of S7001 then ceases to be output, and the VCR is switched to a standby condition.

7. When Timer-Controlled Recording is Completed

When timer-controlled recording is completed, the starting time for recording and the ending time for recording in the memory of the microcomputer are cleared. As a result, when the REC START button is pressed, the cleared starting time for recording is output from pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32) of Q7001 and the indication [–:– –] is indicated on the fluorescent display.

However, in the everyday recording mode [d:E], even at the end of timer-controlled recording, the starting time for recording and the ending time for recording are not cleared.

8. Sleep Recording

If the TIMER button is pressed while the POWER ON button is in the pressed position, and the VCR is recording, recording will continue. This is called sleep recording. In the sleep recording function, when the end of the tape is reached, the power supply will automatically switch to the standby condition

a. While the POWER ON button is in the pressed position, if the VCR is recording, a REC PAUSE signal is output from terminal (2) of S7004 and input to the timer circuit.

b. Pin (36) of Q7001 becomes V_{GG} (+5 V) in the same sequence as for timer-controlled recording.

c. If the TIMER button is pressed at this time, +15 V is supplied to terminal (5) of S7001.

d. The +15 V input to terminal (5) of S7001 passes through R7023, enters the base of Q7005, Q7005 switches ON, and pin (35) of Q7001 becomes V_{GG} (+5 V). At this time, both pin (35) and pin (36) of Q7001 are at V_{GG} level, a timer out signal is output from pin (15) of Q7001, and the condition of the VCR is the same condition as that for timer-controlled recording.

e. Sleep recording ends at the end of the tape. It is exactly the same operation as when timer-controlled recording ends at the end of the tape.

9. Oscillation Circuit

The oscillation circuit is composed of pin (1) and (42) of Q7001, and the ceramic oscillators (F7001, R7015, C7008, and C7009). The oscillation frequency is 400 kHz ± 5 kHz.

10. Reset Circuit

The microcomputer (Q7001) must be reset when power is supplied. The reset circuit is shown in Fig. 2-5-4.

The changing of input terminals (a) and (b) of Q7002 as shown in Fig. 2-5-5, generates a triangular wave, and inputs to pin (7) of Q7001. As a result, the microcomputer is reset, and excecutes the program from the beginning.

At the beginning of the program, there is an order to cause the current time readout to flash on and off. The "0:00" readout output from pin (2) ~ pin (11), pin (16) ~ pin (19), and pin (22) ~ pin (32) flashes on and off, and is output to pin (6) ~ pin (33) of the fluorescent display.

11. REW STOP signal

Because the MEMORY switch of the tape counter is connected to the timer circuit board, that signal is output to system control circuit (SY-1 circuit board).

The REW STOP signal has no relation to the operation of the timer circuit.

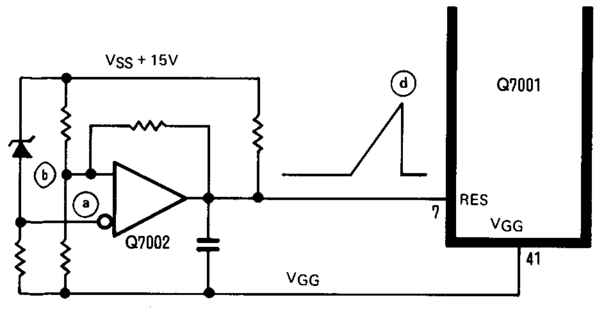


Fig. 2-5-4

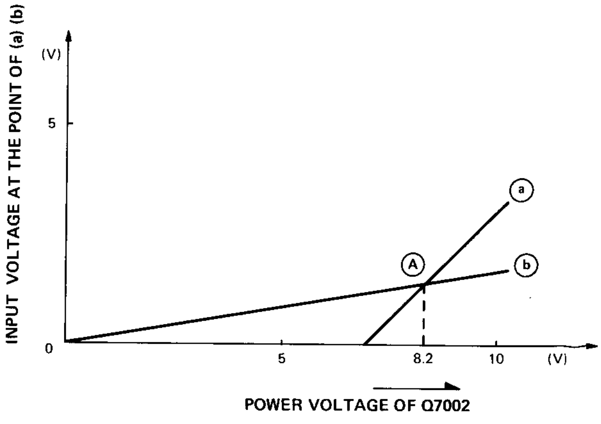


Fig. 2-5-5

VII. TUNER CIRCUIT

A. TUNER CIRCUIT

This is a UHF/VHF combination tuner which receives TV signals in the European 2 through 12 and 21 through 69 channel bands. (Refer to the block diagram in Fig. 2-6-1.)

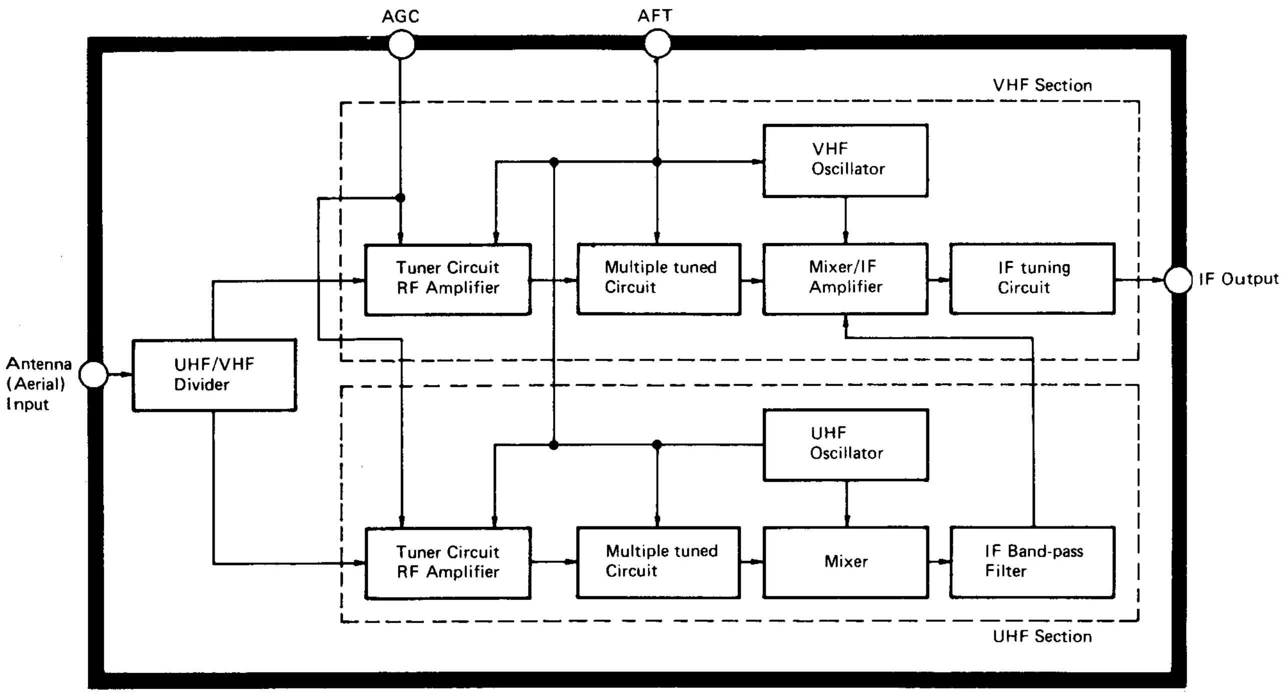

AGC
AFT
VHF Section
VHF Oscillator
Tuner Circuit RF Amplifier
Multiple tuned Circuit
Mixer/IF Amplifier
IF tuning Circuit
IF Output
Antenna (Aerial) Input
UHF/VHF Divider
UHF Oscillator
Tuner Circuit RF Amplifier
Multiple tuned Circuit
Mixer
IF Band-pass Filter
UHF Section

Fig. 2-6-1 Block diagram of tuner circuit

a. Antenna

The antenna employs a phono jack

b. UHF/VHF divider

The UHF/VHF divider employs a low-pass filter and a high-pass filter to divide the UHF and VHF signals.

c. VHF tuner circuit and RF amplifier

The VHF tuner circuit and the RF amplifier suppress all signals other than the desired channel signal and amplifies the desired channel signal. The AGC circuit is engaged by the signal strength and the output voltage is made uniform.

d. Multiple tuned circuit

The multiple tuned circuit has high selectivity characteristics and suppresses all signals other than the desired signal.

e. Oscillator circuit

The oscillator circuit generates the signal required for converting the desired signal into the IF signal.

f. Mixer/IF amplifier

This curcuit functions as the VHF mixer and UHF IF amplifier. When VHF signals are received, the output signal of the VHF oscillator and the channel signal being received are mixed and converted into the IF signal. When UHF signals are received, the circuit functions to amplify the signals which are converted into the IF signal.

g. IF tuning circuit

This is the single tuned circuit for the IF signal.

h. UHF section

The UHF section contains the following circuits just like the VHF section:

(1) Tuned circuit/RF amplifier
(2) Multiple tuned circuit
(3) Oscillator
(4) UHF mixer

An IF bandpass filter with high selectivity characteristics is employed.

i. AFT

The AFT circuit maintains the IF output signal frequency at a constant level.

B. VIF CIRCUIT

The VIF circuit serves to obtain the required selectivity response and to amplify and video detect the VIF signal. (Refer to the block diagram in Fig. 2-6-2.)

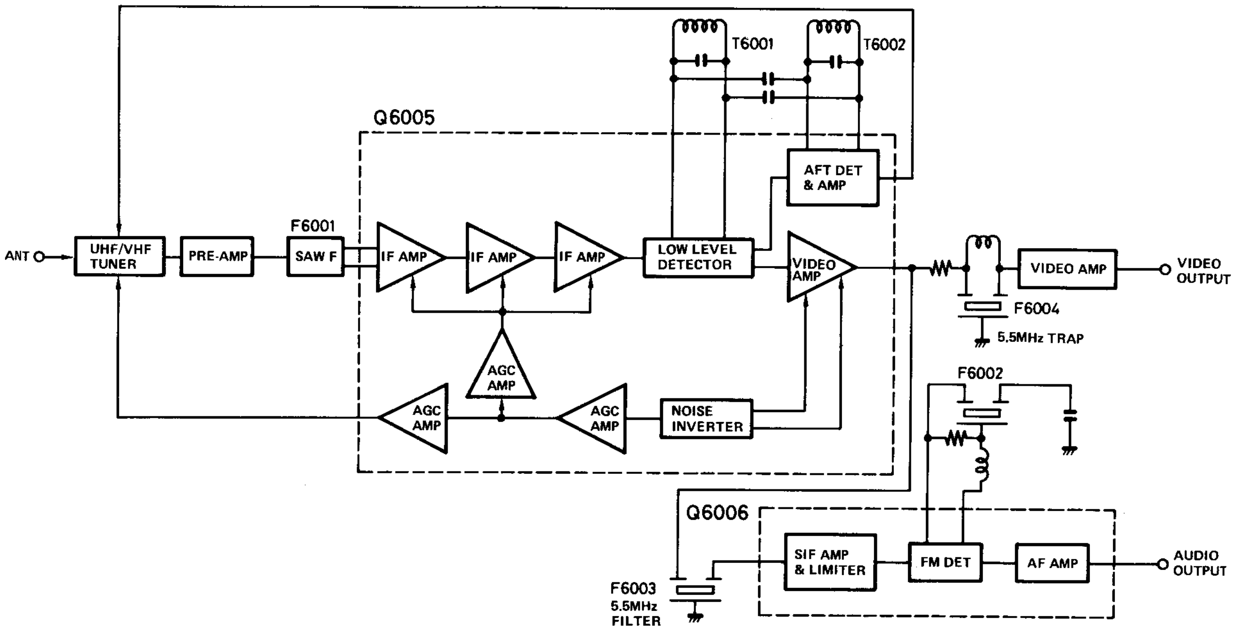

ANT
UHF/VHF TUNER
PRE-AMP
F6001
SAW F
Q6005
IF AMP
IF AMP
IF AMP
LOW LEVEL DETECTOR
T6001
T6002
AFT DET & AMP
VIDEO AMP
AGC AMP
AGC AMP
AGC AMP
NOISE INVERTER
VIDEO AMP
VIDEO OUTPUT
F6004
5.5MHz TRAP
F6002
Q6006
SIF AMP & LIMITER
FM DET
AF AMP
AUDIO OUTPUT
F6003
5.5MHz FILTER

Fig. 2-6-2 Block diagram of VIF circuit and SIF circuit

a. Pre-amplifier

The required selectivity characteristics are produced by the surface acoustic wave filter (SAW F). The SAW filter also experiences a loss effect and, therefore, an amplifier is required to compensate for this loss. In order to improve the signal to noise ratio, an emitter-earthed single-stage amplifier (Q6001) is employed before the SAW filter.

b. VIF amplifier, video detector, AFT, and AGC

The VIF signal enters Q6005 from the SAW filter. This IC is composed of the VIF amplifier, the video detector, the AFT circuit, and the AGC circuit. (Refer to Fig. 2-6-4.)

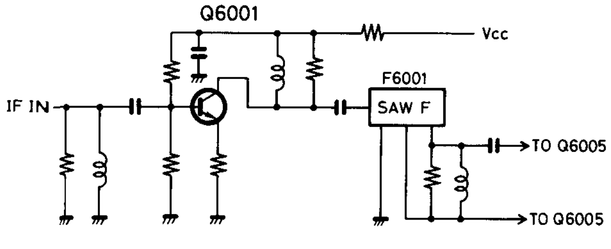

Q6001
Vcc
F6001
SAW F
IF IN
TO Q6005
TO Q6005

Fig. 2-6-3

(1) VIF amplifier

The signal is amplified by this 3-stage variable gain IF amplifier.

(2) Video detector

The amplified VIF signal is supplied to the tuning circuit composed of T6001 and C6011, and sync detection is performed. The detected video signal is video amplified while its signal-to-noise ratio is simultaneously improved by the noise inverter circuit.

(3) AFT circuit

This circuit is composed of T6002 and C6012, and includes a phase shifter. The carrier output of the sync detector is connected to the phase shifter and the phase is detected, and therefore, a DC voltage which is proportional to the VIF carrier is obtained.

(4) AGC circuit

The AGC circuit is required to maintain the video output at a constant level in respect to fluctuations in the antenna input voltage. The control takes the form of a peak AGC system. The synchronizing signal level of the video

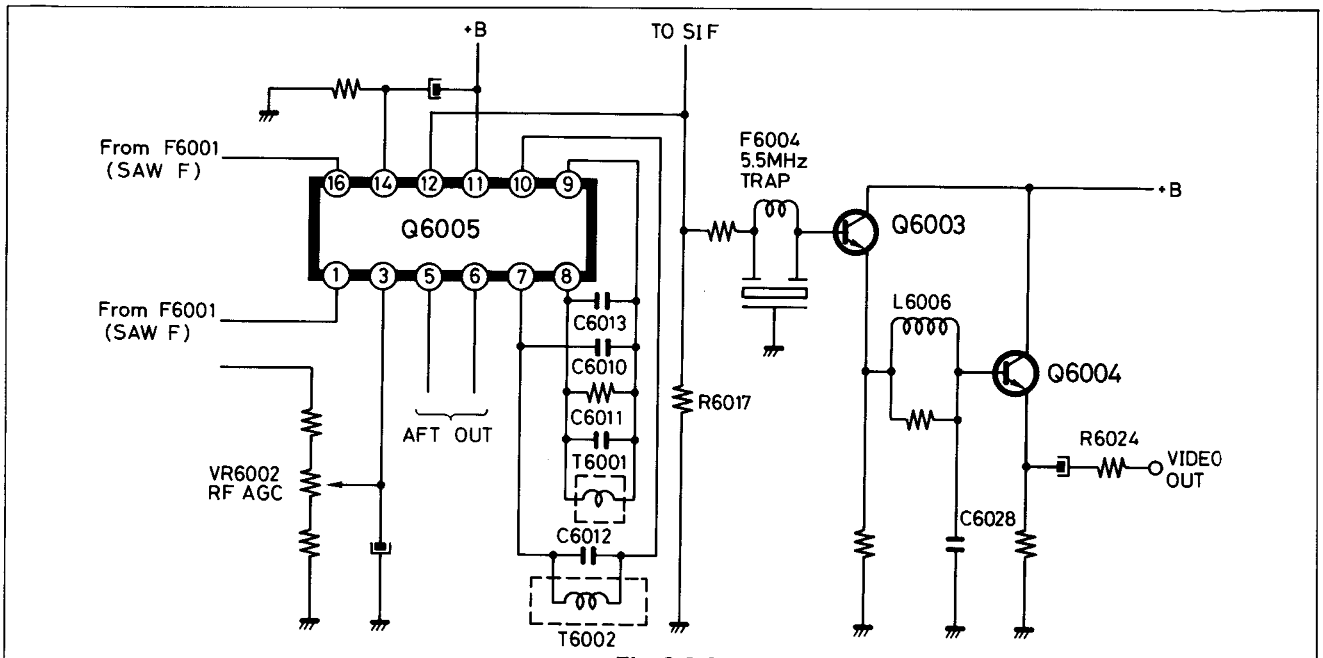


Fig. 2-6-4

signal is detected, and the gain of the VIF amplifier circuit is varied, so that the level is maintained at a fixed value. The AGC voltage is also supplied to the U/V tuner's RF amplifiers of the UHF/VHF tuner, and the gain is varied (RF AGC-reverse AGC). When the antenna input voltage is low, the RF AGC action ceases and the RF amplifier functions at maximum gain. Once the input voltage exceeds approximately 65 dBμ, VR1 is set so that operation begins.

c. Video amplifier circuit

The level of the video signal detected by Q6005 is set by R6024 so that a 1 Vp-p output is obtained at the video output connector (75-ohm termination). The SIF signal contained in the video signal is eliminated by the ceramic trap F6004. Becuase the level of the video signal detected by Q6005 in the vicinity of the chrominance signal (4.43 MHz) is attenuated, the frequency response is smoothed by the L6006 and C6028 tuning circuit.
Finally, the impedance is reduced by the emitter follower and R6024 is applied to set the output impedance to 75 ohms.

C. SIF CIRCUIT

The SIF signal which is contained in the video signal detected by Q6005 is removed by the ceramic filter F6003 and supplied to Q6006. Q6006 is composed of an amplitude-limiter circuit and an FM detector circuit. The SIF signal has its AM component removed by the amplitude-limiter circuit. The signal is then fed into the differential peak detector circuit, and the sound signal is produced.
The sound signal, which has undergone pre-emphasis at the transmission end, now undergoes de-emphasis by C6027 and the internal impedance, and the frequency response is smoothed. The audio output level is adjusted by VR6003.

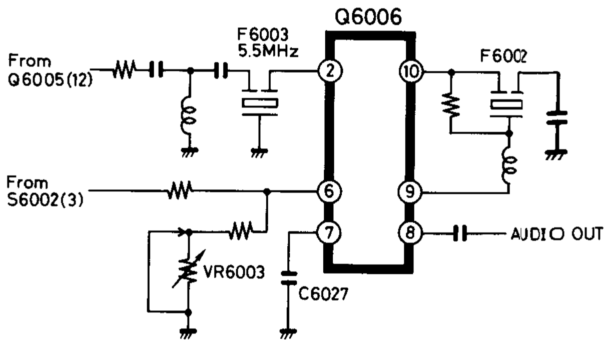


Fig. 2-6-5

D. MUTING CIRCUIT

In the playback mode, both the video signal and the audio signal from the tuner circuit are designed to develop no output in order to prevent interference between the playback signal and the demodulated tuner signal. For this purpose, a voltage forcibly applied to Q6005 at pin (14) increases the AGC voltage for the IF amplifier, which then mutes the video signal output and the SIF signal output.

If there is no broadcast signal entering the tuner, or if the tuning is completely misaligned, and there is no video output, a high voltage will enter pin (3) of S6002, and the audio portion will be muted.

E. VARACTOR TUNING OPERATION

The new VCR model Colour Video Cassette Recorder features a varactor tuning system. The purpose of the varactor tuner is to provide electronic tuning without the use of mechanical tuners. The varactor tuner outputs switching potential to the tuners and a variable tuning voltage to the varactors in the UHF/VHF tuners. The unit has 8 channel selection pushbuttons. Each position can be tuned to any UHF (21 ~ 69) or VHF (2 ~ 12) channel. Once each channel has been preset accurately for reception of the desired broadcasting station, all that the viewer is required to do is simply press the channel button which corresponds to the desired channel. Thus, channel selection can be accomplished instantly.

The tuning and channel selection circuits built into a majority of VCR units depend upon mechanical operation to a varying exent. This means the conventional tuning systems are not free from mechanical malfunctions (due to worn contact points, etc.) which lead to service calls. In this varactor tuning system all mechanically operated parts have been replaced by 8 channel selection pushbutton. Moreover, since channel selection is non-sequential, changing from one channel to another is instantaneously accomplished by pressing the desired pushbutton. The varactor tuning system should extend the service life of the VCR itself, while also increasing its reliability. The circuitry of the varactor tuning system can be broken down into the following three main blocks. (Refer to Fig. 2-6-6.) The following diagram indicates how these three main blocks are inter-related.

(1) Block 1

Push-tuning selectors and channel indicators utilizing LEDs (light emitting diodes).

(2) Block 2

Channel preset assembly consisting of the fine tuning control and the band selectors, which is preset to tune in the desired VHF and UHF stations.

(3) Block 3

UHF-VHF tuning assembly, where the main function of the varactor tuning system is performed.

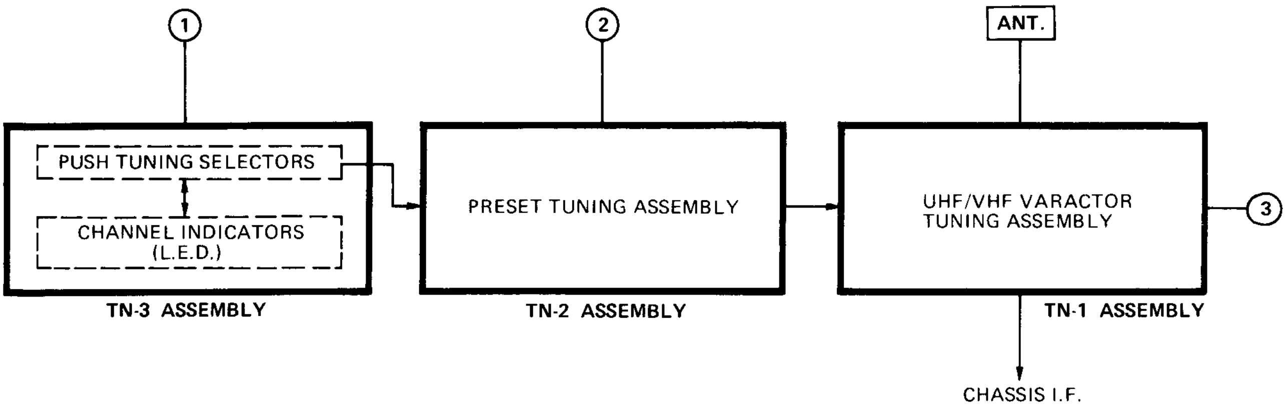

①
②
ANT.
PUSH TUNING SELECTORS
CHANNEL INDICATORS (L.E.D.)
PRESET TUNING ASSEMBLY
UHF/VHF VARACTOR TUNING ASSEMBLY
③
TN-3 ASSEMBLY
TN-2 ASSEMBLY
TN-1 ASSEMBLY
CHASSIS I.F.

Fig. 2-6-6 Varactor tuning system block diagram

The VCR model is equipped with reliable pushbutton operation. The circuit can be described as: the pushbuttons of TN-3 ⟷ the tuning control of TN-2.

By turning the tuning control [(A) of VR6201], which should be preset to the desired channels, the resistance of VR6201 changes, thus controlling the amount of conduction of Q6201 through D6215 and VR6201. The voltage at the emitter of Q6201 is applied to the varactor tuner as tuning voltage. There are eight identical channel selection circuits as shown in Fig. 2-6-7. The channel selection pushbutton selects the desired circuit (channel), and also causes the corresponding channel indicator LED to illuminate.

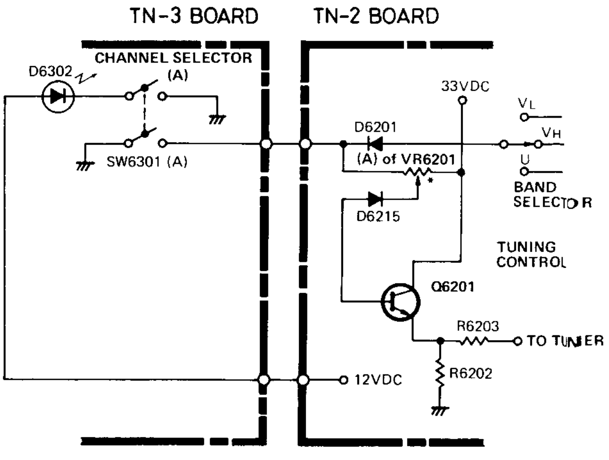

TN-3 BOARD
TN-2 BOARD
CHANNEL SELECTOR (A)
D6302
SW6301 (A)
33VDC
D6201
(A) of VR6201
D6215
V_L
V_H
U
BAND SELECTOR
TUNING CONTROL
Q6201
R6203
TO TUNER
R6202
12VDC

Fig. 2-6-7

VIII. POWER SUPPLY CIRCUIT

1. Outline

The power supply circuit is composed of the power supply transformer and two circuit boards, the AC power supply circuit (PW-2 circuit board) and the DC power supply circuit (PW-1 circuit board). A block diagram of the power supply circuit is shown in Fig. 2-7-1.

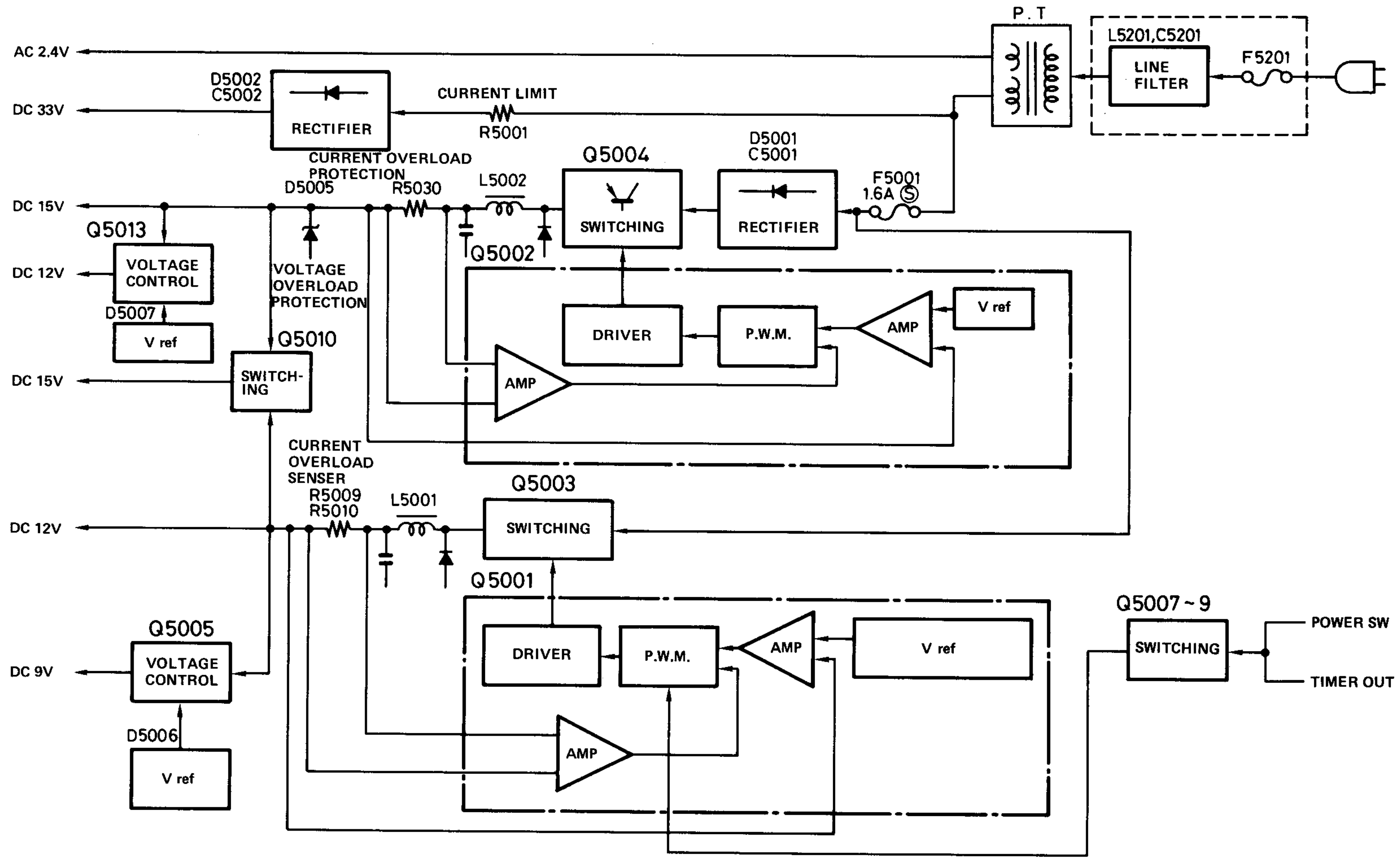

AC 2.4V
DC 33V
DC 15V
DC 12V
DC 15V
DC 12V
DC 9V
P.T
L5201,C5201
LINE FILTER
F5201
D5002
C5002
RECTIFIER
CURRENT LIMIT
R5001
CURRENT OVERLOAD PROTECTION
D5005
R5030
L5002
Q5004
SWITCHING
D5001
C5001
RECTIFIER
F5001
1.6A Ⓢ
Q5013
VOLTAGE CONTROL
D5007
V ref
VOLTAGE OVERLOAD PROTECTION
Q5002
Q5010
SWITCH-ING
DRIVER
P.W.M.
AMP
V ref
AMP
CURRENT OVERLOAD SENSER
R5009
R5010
L5001
Q5003
SWITCHING
Q5001
DRIVER
P.W.M.
AMP
V ref
AMP
Q5005
VOLTAGE CONTROL
D5006
V ref
Q5007~9
SWITCHING
POWER SW
TIMER OUT

Fig. 2-7-1

2. AC Power Supply Circuit (PW-2 Circuit Board)

AC 220 V 50 Hz is input from the power cord to the PW-2 circuit board. This power supply passes through fuse F5201 (630 mA) and the line filter which is composed of C5201 and L5201, and is then connected to the power supply transformer by LW5203 and LW5204.

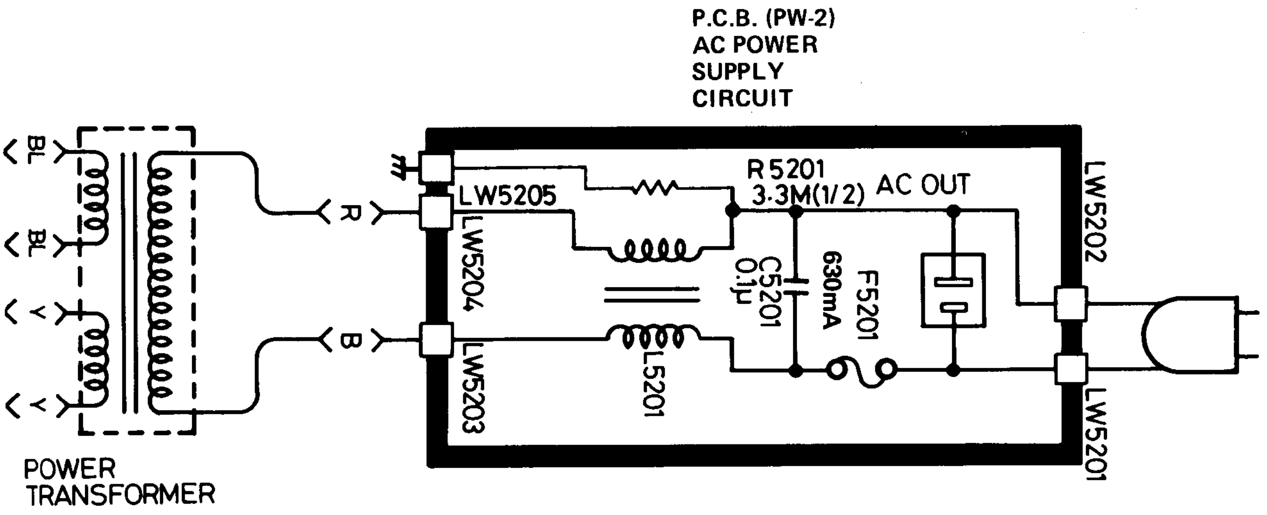

P.C.B. (PW-2)
AC POWER
SUPPLY
CIRCUIT
BL
BL
V
V
R
B
LW5205
LW5204
LW5203
R5201
3.3M(1/2)
AC OUT
C5201
0.1μ
F5201
630mA
L5201
LW5202
LW5201
POWER
TRANSFORMER

Fig. 2-7-2 AC power supply circuit

3. DC-DC Converter Constant Voltage Circuit (PW-1 Circuit Board)

The DC-DC converter constant voltage circuit has a DC +12 V output circuit and a DC +15 V output circuit. Because the circuit composition of both circuits is essentially the same, only the DC +12 V output will be explained herein. The DC-DC converter constant voltage circuit outputs REG +12 V through a frequency-fixing pulse-width modulation system step-down switching regulator. Next, a simple explanation of the circuit operation will be given.

The control IC Q5001 controls the main transistor Q5003 at the oscillated switching frequency (21 kHz) through C5013 and R5027. The DC voltage is pulsated by Q5003, and passes through a filter composed of L5001 and C5007, and is supplied to the load.

While Q5003 is ON, the current flows to the load through L5001 and C5007; when Q5003 switches OFF, the energy stored in L5001 passes through the closed circuit composed of D5003 (1/2), and the current is supplied to the load. Accordingly, the current which flows to L5003 becomes a triangular wave; however, in order to absorb the alternating current through C5007, the direct current is supplied to the load.

As stated previously, the DC voltage is supplied to the load; however, the control IC for stabilization of the output voltage is Q5001 (the frequency-fixing pulse-width modulation system switching regulator power supply control IC). (Refer to Fig. 2-7-3.)

The fluctuation Va of the output voltage is detected by

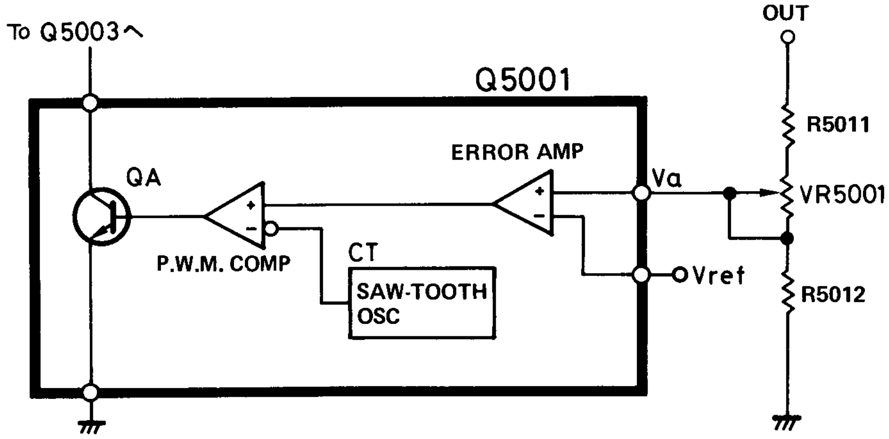
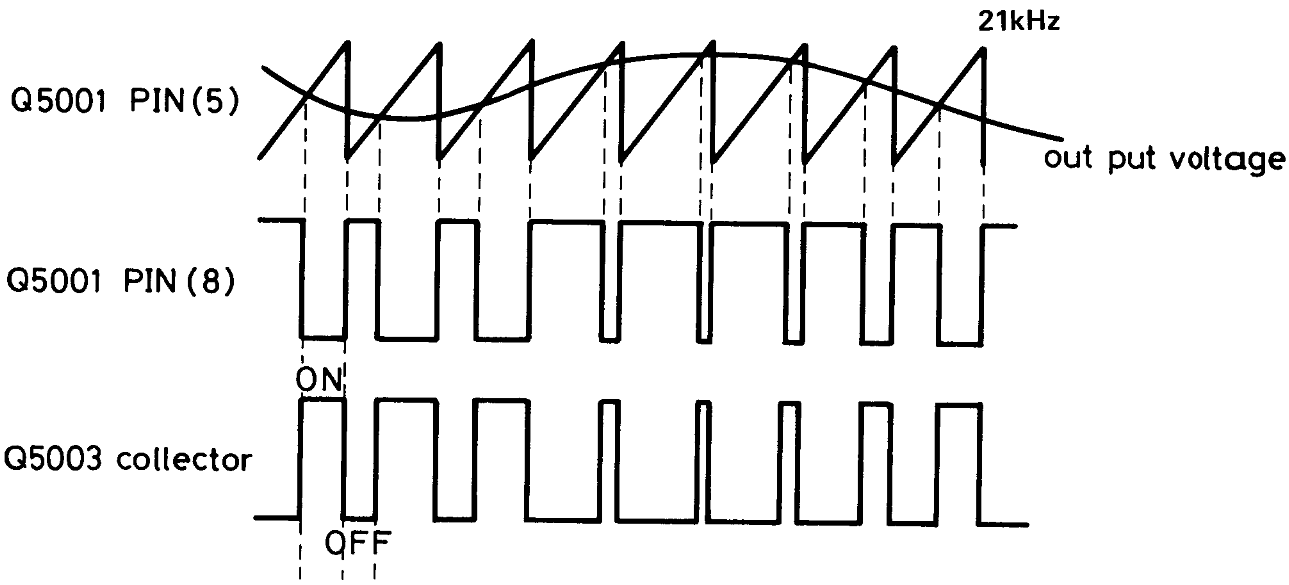

To Q5003
OUT
Q5001
R5011
ERROR AMP
QA
Va
VR5001
P.W.M. COMP
CT
Vref
SAW-TOOTH
OSC
R5012

Fig. 2-7-3

R5011, R5012, and VR5001, and is input to pin (1) of Q5001. Also, the +5 V output from pin (14), which is the internal reference of Q5001 used for voltage comparison, is voltage divided by R5013 and R5014, and then input to pin (2) of Q5001. The voltage fluctuation, which was input to pin (1) of Q5001 and compared with the reference voltage of pin (2), is amplified by the error amplifier located within Q5001. The amplified fluctuation is input to the internal comparator of Q5001. Here, a saw-tooth wave is added to the input of the comparator, both of these are compared, the pulse width modulation (PWM) is output from the internal transistor of Q5001, and the constant output (REG +12 V) is obtained.

The modulated wave is shown in Fig. 2-7-4.


21kHz
Q5001 PIN(5)
out put voltage
Q5001 PIN (8)
ON
Q5003 collector
OFF

Actual waveform

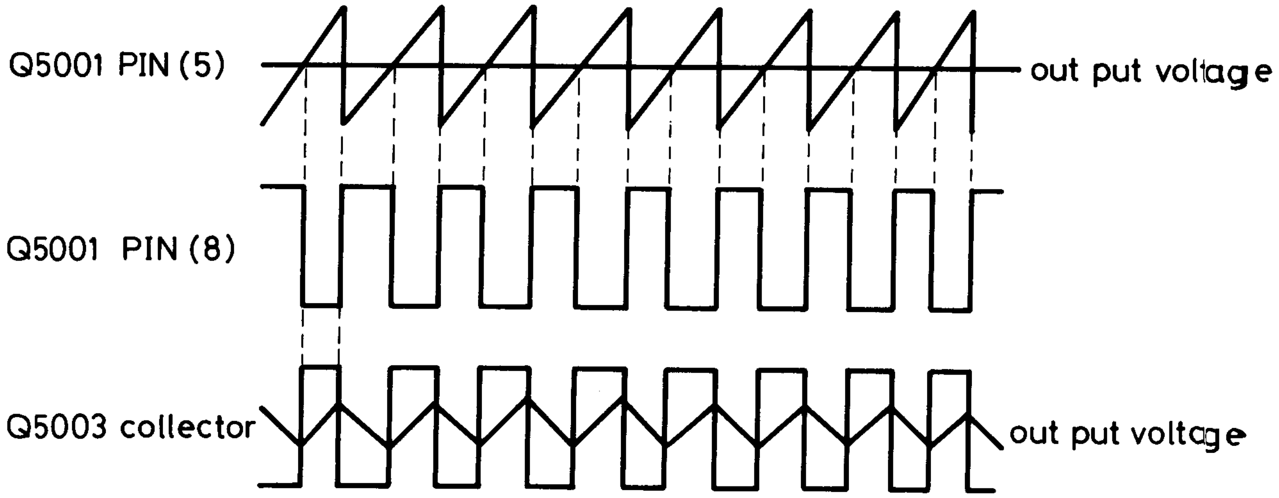

Q5001 PIN (5)
out put voltage
Q5001 PIN (8)
Q5003 collector
out put voltage

Fig. 2-7-4 PWM modulated waveform

4. Protection Circuits

a. Current overload protection circuit

There is another error amplifier in Q5001, and this is utilized to perform current limiting. R5009 and R5010 of Fig. 2-7-5 are detection resistors. When the voltage drop at both ends of R5009 is equivalent to the voltage at both ends of R5007, current limiting is done. When current limiting begins, the output voltage begins to drop, and, because of this, the voltage at both ends of R5007 decreases. In order to maintain this current limiting, the current output falls, and the voltage drop at both ends of R5009 also decreases. This condition can be visually represented by the 7-shaped characteristic shown in Fig. 2-7-5.

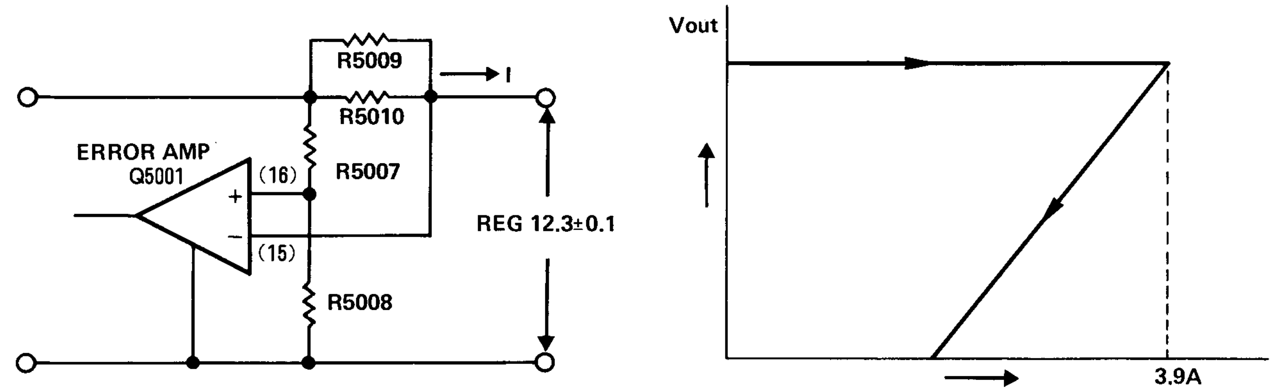


Fig. 2-7-5 Current limiting circuit and 7-shaped characteristic

b. Voltage overload protection circuit

As shown in Fig. 2-7-6, a zener diode (D5004) is located at the output edge, and, if a voltage higher than the zener voltage of the zener diode appears at the output edge, the fuse (F5001) opens and a voltage overload is prevented.

5. +9 V Output Regulator Circuit

This circuit is composed of a series down system regulator circuit which receives a +12 V input and outputs +9 V. The +9 V output regulator circuit is shown in Fig. 2-7-7.

6. Switching Circuit (+12 V Output: ON/OFF)

The switching circuit is shown in Fig. 2-7-8, and the power switch operation table is shown in Table 2-7-1.

a. When the power switch is ON:

The base current flows through R5018 to Q5009, Q5009 switches ON, and Q5007 switches OFF. As a result, the "dead-time" terminal of Q5001 is earthed, the dead time becomes 3% smaller, the output flows, and the VCR becomes ON.

b. When the power switch is in the standby state:

Because the base of Q5009 is earthed, Q5009 switches OFF. The base current flows through R5016 to Q5008, causing it to switch ON. Because of this, the "dead-time" terminal of Q5001 becomes 5 V, the dead time becomes approximately 100%, Q5003 switches OFF, the output does not flow, and the VCR becomes OFF.

c. When the power switch is in the timer state:

If the power switch is at the timer side, Q5009, in accordance with the timer signal, switches ON or OFF, and, simultaneously with the switching ON and OFF of the power switch, the power is switched ON or OFF.

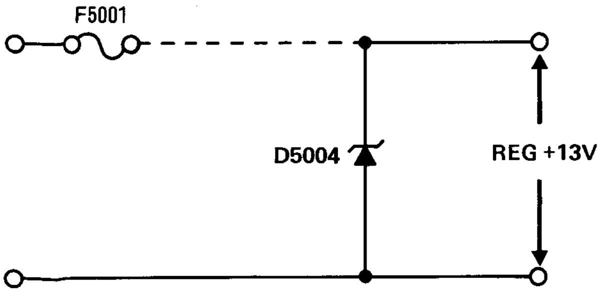


Fig. 2-7-6

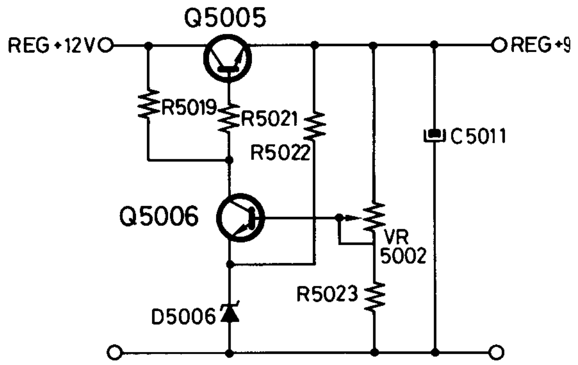


Fig. 2-7-7 +9 V output regulator circuit

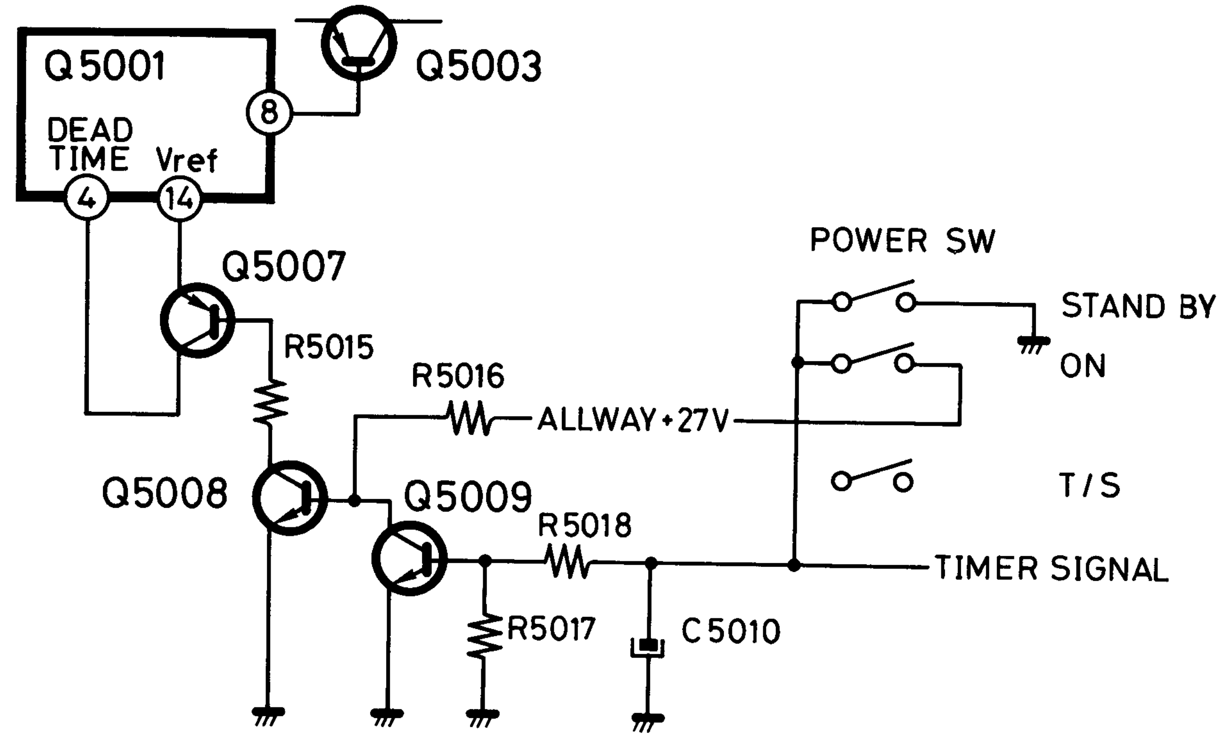

Q5001
DEAD TIME
Vref
8
4
14
Q5003
Q5007
R5015
R5016
ALLWAY+27V
POWER SW
STAND BY
ON
T/S
Q5008
Q5009
R5018
R5017
C5010
TIMER SIGNAL

Fig. 2-7-8 Switching circuit

POWER SW. MODE		Q5009	Q5008	Q5007	Pin (4) of Q5001	Constant voltage circuit operation
ON		ON	OFF	OFF	H	15 V, 12 V, 9 V, all circuits ON
STAND BY		OFF	ON	ON	L	12 V, 9 V, circuit OFF
T/S	TIMER H	ON	OFF	OFF	H	All circuits ON
	TIMER L	OFF	ON	ON	L	12 V, 9 V, circuit OFF

Table 2-7-1 Switching circuit operation

7. Switching Circuit for +15 V Tuner Power Supply

Because the +15 V tuner power supply, just as the +12 V and +9 V output circuits, must be output when the power switch is in the standby state, a switching circuit is necessary.

As shown in Fig. 2-7-9, while REG +12 V is input to the base of Q5011, Q5011 is ON; furthermore, Q5010 switches ON (saturated), and +15 V is supplied to the tuner circuit. Also, if the power switch is in the standby state, +12 V is not input to the base of Q5011, and, therefore, both Q5011 and Q5010 switch OFF, and +15 V is not supplied to the tuner circuit.

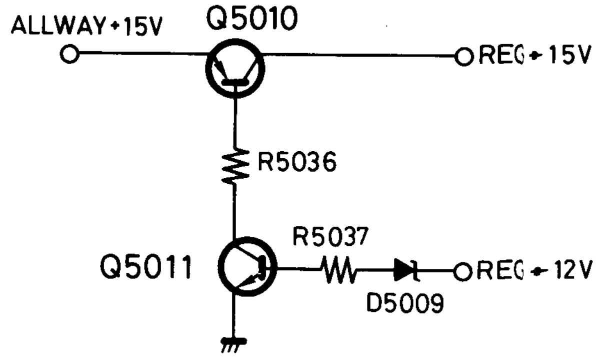

ALLWAY+15V
Q5010
REG+15V
R5036
R5037
Q5011
REG+12V
D5009

Fig. 2-7-9 Switching circuit for +15 V tuner power supply

8. Power Supply Destinations and Voltages

SUPPLY VOLTAGE \ CIRCUIT	VIDEO	SYSTEM CONTROL	SERVO	TUNER	TIMER	RECONVERTE
All way + 33V				○		
All way + 15V					○	
All way + 12V						○
All way AC2.4V					○	
REG + 15V				○		
REG + 12V	○	○	○	○		
REG + 9V	○	○				

Table 2-7-2

IX. MECHANISM DESCRIPTION

A. FEATURES

1. Mechanism Chassis

The chassis which form the base for the mechanism are constructed as follows:

a. Drum chassis (main chassis)

This chassis is constructed of die-cast aluminium, and is mainly for mounting the tape path system and the video head drum.

b. Reel chassis (sub chassis)

this chassis is constructed of glass-fiber-strengthened plastic, and is mainly for mounting the reel drive system, the loading drive system, and the eject mechanism. It is mounted on the drum chassis (main chassis).

2. Motor and Solenoid Structure

The motors and solenoids (three motors and three solenoids) which drive the mechanism consist of the following:

a. Head motor

* Brushless DC motor.
* Direct drive (D.D.) system built into the video head drum.

b. Capstan motor

* Brushless DC motor.
* Capstan-integrated direct drive (D.D.) system.

c. Reel motor

* DC motor.
* Reel base and loading drive by belts and gears.
* Combined loading motor.

d. Pinch roller pressure solenoid

* Pinch roller pressure operation.
* Reel base brake release operation.

e. Fast forward/rewind solenoid

* Speed reduction mechanism and clutch switching operation.
* Reel base brake release operation.

f. EJECT solenoid

* Eject operation.

Mode	Video head motor	Capstan motor	Reel motor	Pinch-roller pressure solenoid	Fast forward/ rewind solenoid	Reel base speed	Eject solenoid
LOADING	ON	OFF	ON; CW	OFF	OFF	—	OFF
STOP	OFF	OFF	OFF	OFF	OFF	—	OFF
PLAY, FWD, REC	ON	ON; ACW	ON; CW	ON	OFF	LOW	OFF
F FWD	ON	OFF	ON; CW	OFF	ON	HIGH	OFF
REW	ON	OFF	ON; ACW	OFF	ON	HIGH	OFF
EJECT	ON	OFF	ON; ACW	OFF	ON	HIGH	OFF

CW: Clockwise AW: Anti-clockwise

Table 3-3-1

3. Mechanism Operation

The handling of the switching of the mechanism in each mode is carried out by a combination of solenoid operation together with capstan motor and reel motor operation.

(a) Switching of the idler gear to the supply reel base of the reel base drive, or to the take-up reel base, is performed by the rotation force and rotation direction of the reel motor.

(b) The idler gear is moved up and down by the fast forward/ rewind solenoid, and carries out slip-mechanism switching of the reel base drive reduction ratio for playback tape motion.

(c) For loading and unloading, the loading ring is driven by the power of the reel motor through belts and gears.

(d) For cassette-up operation, the eject roller is pressed against the capstan motor by the operation of the eject solenoid, and the mechanism is switched to the CASSETTE-UP mode by the power of the capstan motor.

B. SAFETY DEVICES

1. Tape End Detection Device (Refer to Fig. 3-2-1.)

Video cassette tape has "trailer tape" made of nonmagnetic material at both ends of the magnetic tape. The tape end is detected when the forward sensor or the reverse sensor senses this trailer tape. (Refer to section IV, SYSTEM CONTROL CIRCUIT.) As outlined below, each mode is changed to the REW mode or STOP mode by the signal output from Q3005 (LA7011; SY-1 system control circuit) of the tape end sensor circuit.

a. Detection of tape end by the forward sensor

(1) PLAY and REC modes

The pinch roller pressure solenoid (1) is released, and the brakes (supply reel brake and take-up reel brake) (2) are engaged. The fast forward/rewind solenoid (3) is then engaged, and the VCR is set to the REW mode.

(2) F FWD mode

The fast forward/rewind solenoid (3) is released, and the brakes (supply reel brake and take up reel brake) (2) are engaged. The idler year (4) is then switched by the fast forward/rewind solenoid (3), and the VCR is set to REW mode.

b. Detection of tape end by the reverse sensor

(1) REW mode

The fast forward/rewind solenoid (3) is released, the brakes (supply reel brake and take-up reel brake) (2) are engaged, and the VCR is set to the STOP mode.

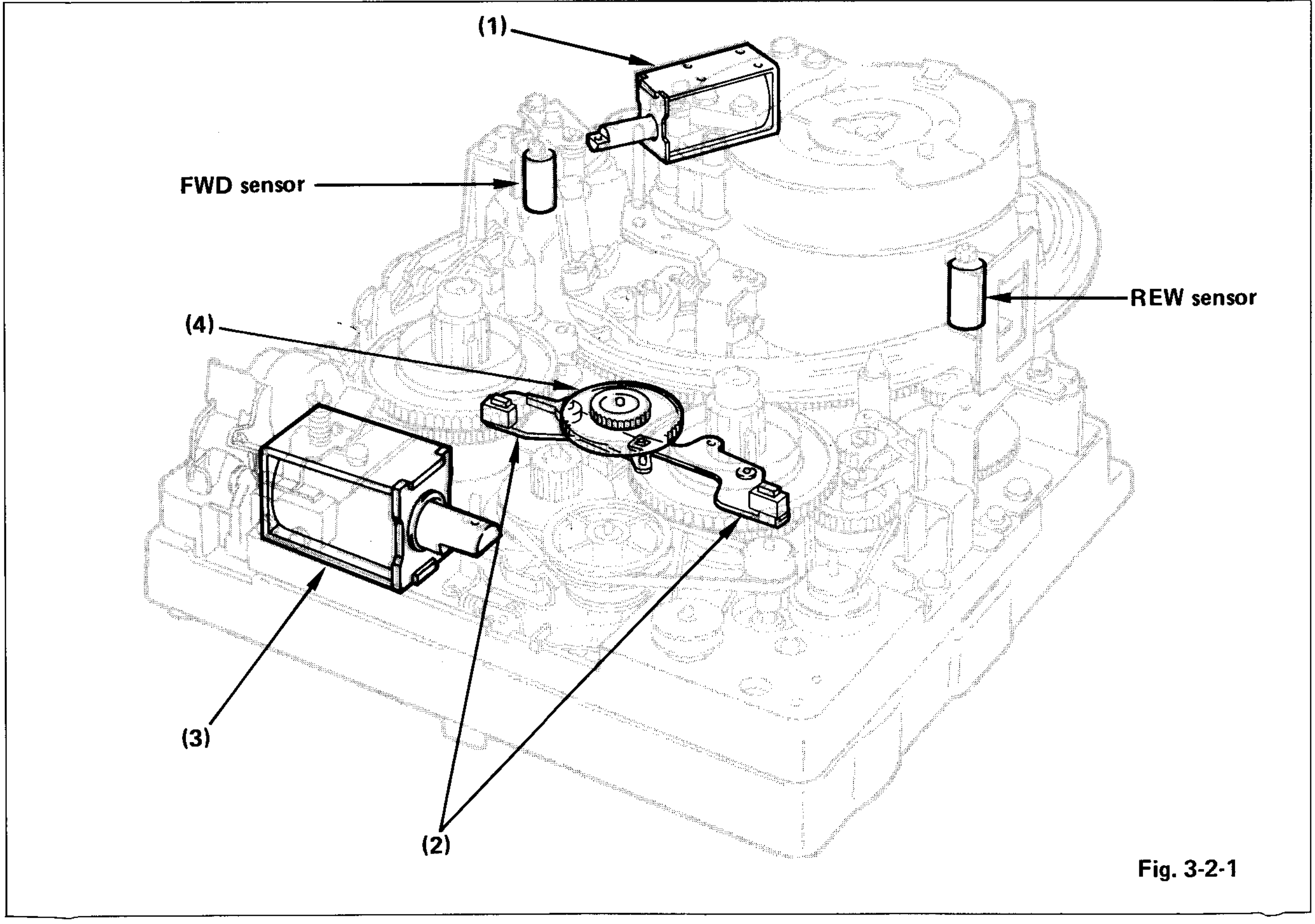


Fig. 3-2-1

2. **Dew Sensing Device** (Refer to Fig. 3-2-2)

If the temperature or humidity changes sharply, condensation or moisture may form on the surface of the drum. If this happens, the dew sensor detects the moisture condensation, the pinch-roller pressure solenoid (1), or the fast forward/rewind solenoid (3), is released, the brakes (2) are engaged, and the VCR is set to the STOP mode. By setting the VCR to the STOP mode, damage to the tape and mechanism is prevented. When the dew sensor operates, an LED illuminates. At this time no mode can be operated except CASSETTE-UP.

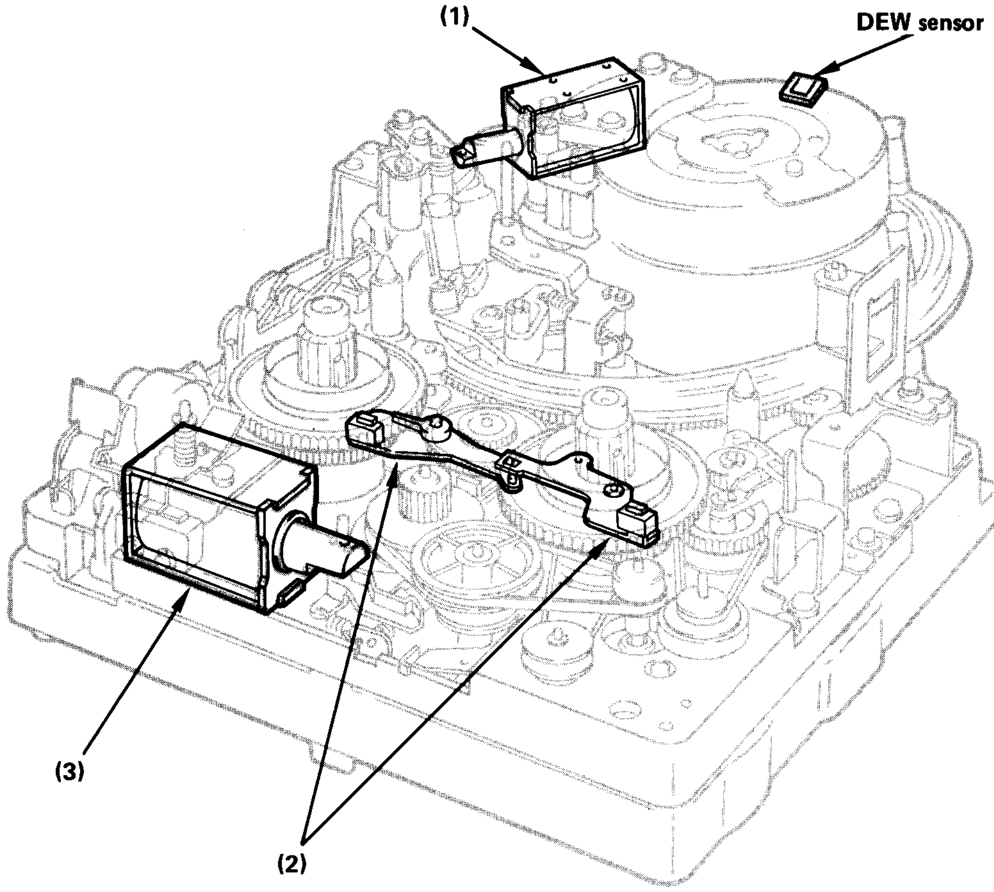


Fig. 3-2-2

3. **Take-Up Reel Base Rotation Sensing Device**
(Refer to Fig. 3-2-3.)

In every mode except PAUSE, damage to the reel motor, or severing of the belt, will cause the take-up reel base to stop, which could cause the tape to become slack, thus damaging the tape. In order to prevent this, a detection mechanism, composed of a magnet (2) attached to the tape counter (1) and a magnetic reluctance element (3) positioned nearby, senses the rotation of the take-up reel base. When the take-up reel base rotates, the rotation is transferred to the tape counter (1) through the belt (4), and the magnet (2) gives a pulse-like signal to the magnetic reluctance element (3).

If the take-up reel base stops, because this signal becomes constant (refer to section IV, SYSTEM CONTROL CIRCUIT), the stopping of the take-up reel base is detected, and the unit automatically switches to the STOP mode, thus stopping the tape travel and preventing damage to the tape.

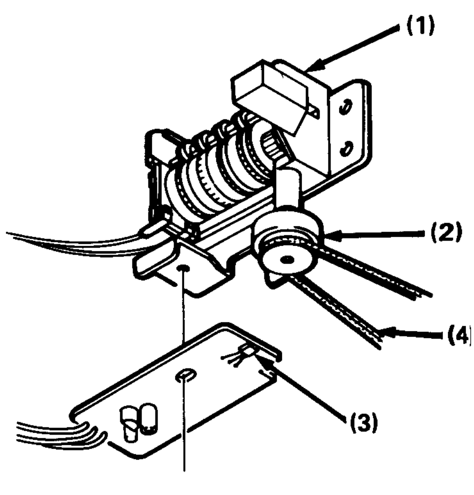


Fig. 3-23

C. MECHANISM OPERATION IN EACH MODE

1. From Cassette Insertion to Loading Completion

(Refer to Figs. 3-3-1 ~ 3-3-5.)

With the POWER ON button in the pressed position during the period between cassette insertion and completion of cassette loading, when the cassette is inserted the lock on the cassette holder lid is released. When the cassette holder is pushed down, the lid is opened by the cassette lid guide (1). As the cassette descends, the cassette detection lever (2) is pushed down, and the cassette holder is locked by the cassette holder lock lever (3), and, at the same time, the cassette switch (4) is switched ON. At that time, the loading stopper release slide (5) moves in the direction indicated by the arrow, and the loading ring lock lever (6) is released. (Refer to Figs. 3-3-1 and 3-3-2.)

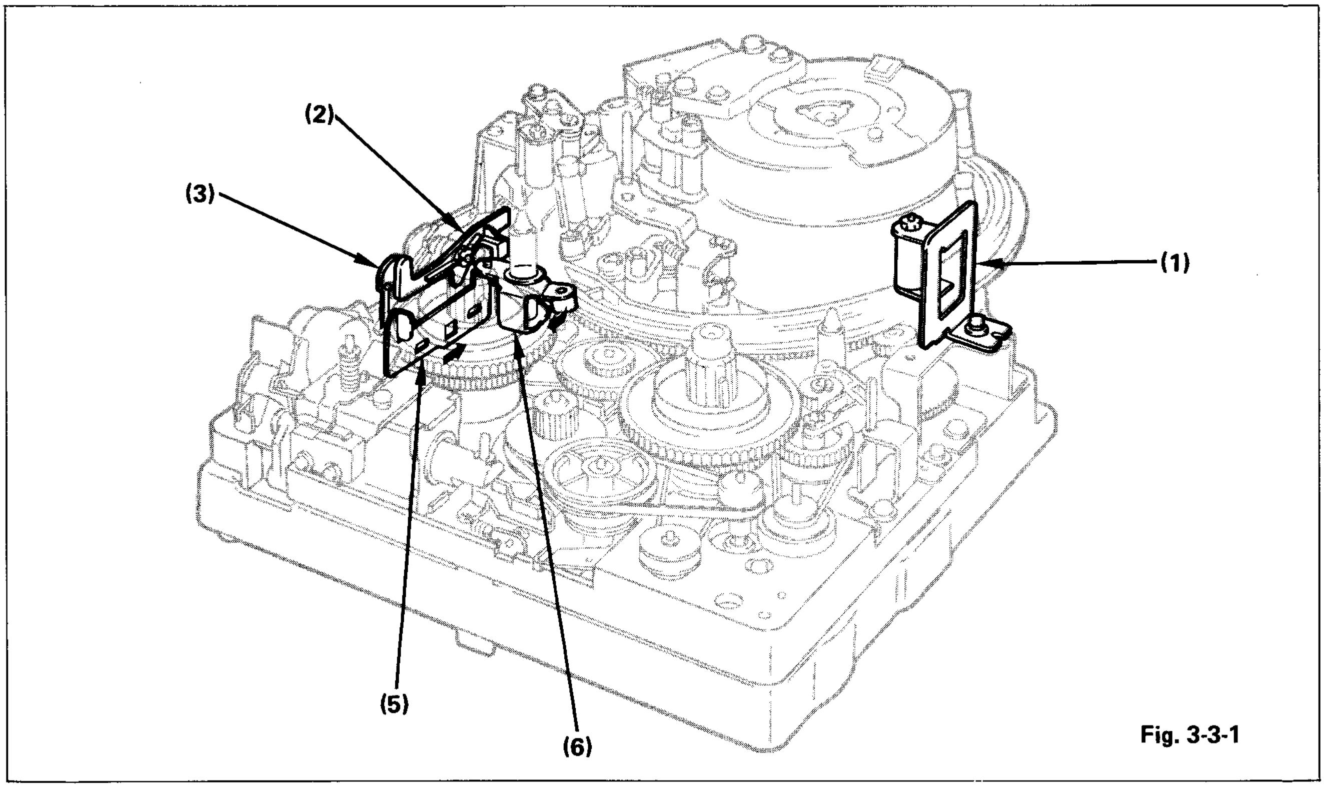


Fig. 3-3-1

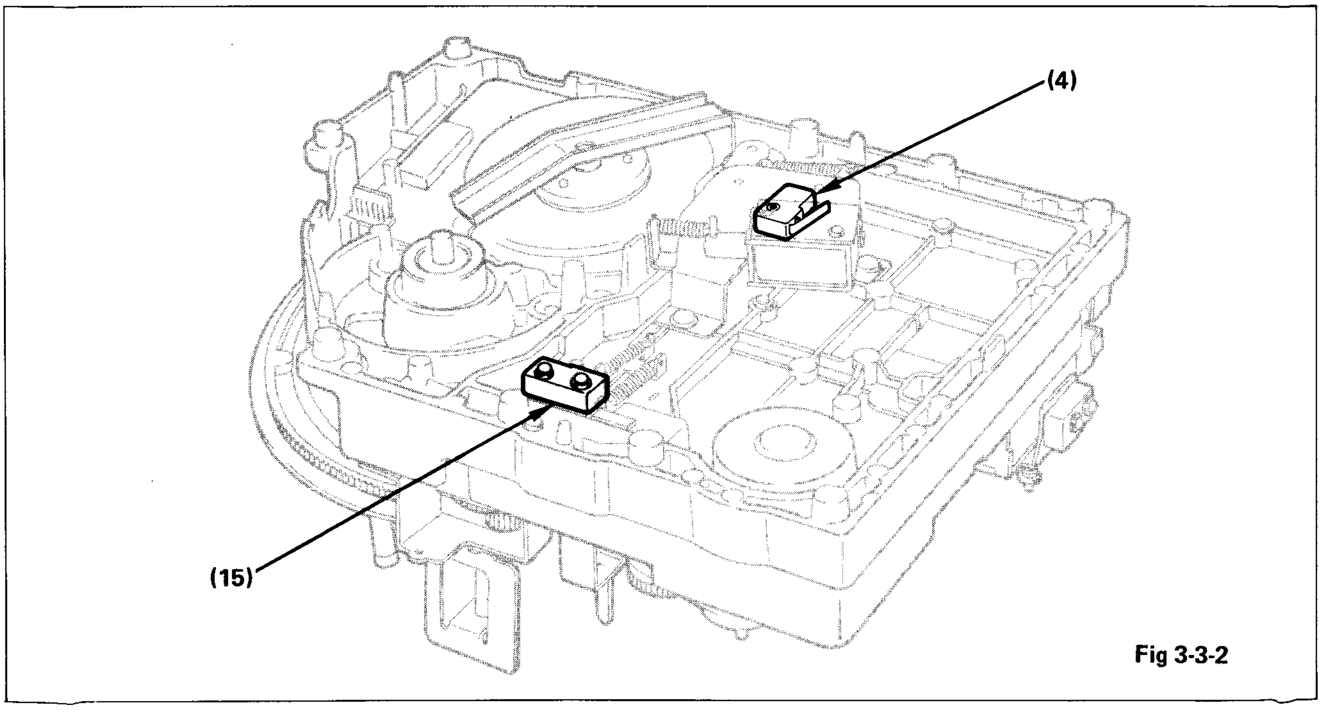


Fig 3-3-2

When the cassette switch (4) is switched ON, the reel motor (7) rotates in the anti-clockwise direction, and the loading roller (9), which is pressed against the reel motor pulley (8), rotates. The rotation of the loading roller (9) is conveyed to the loading ring (10) by a belt and gears, and the loading ring (10) begins to rotate in the anti-clockwise direction. The supply reel brake (12) and the take-up reel brake (13) are released by the loading end lever (11), which moves in the direction indicated by the arrow at the beginning of loading ring rotation. (Refer to Fig. 3-3-3.)

The cassette tape is pulled out by the guides of the loading ring (10), and is wound toward the erase head, video head drum, and audio/control head. Each part of the loading ring has a cam, and, when section A of the cam reaches the position of the loading end roller (14), the loading end roller (14) enters into section A. In accordance with the movements of the loading end roller (14), at the same time as the loading ring (10) becomes locked, the loading roller (9) moves away from the reel motor pulley (8), and, furthermore, the loading end switch (15) is switched OFF, thus completing the LOADING mode. When loading is completed, the supply reel brake (12) and the take-up reel brake (13) are each pressed against the reel base. At the same time, the back tension operation lever (16) is rotated in the anti-clockwise direction by the B section of the loading ring (10) cam, and the back tension lever (17) is set. (Refer to Fig. 3-3-4 and Fig. 3-3-5.)

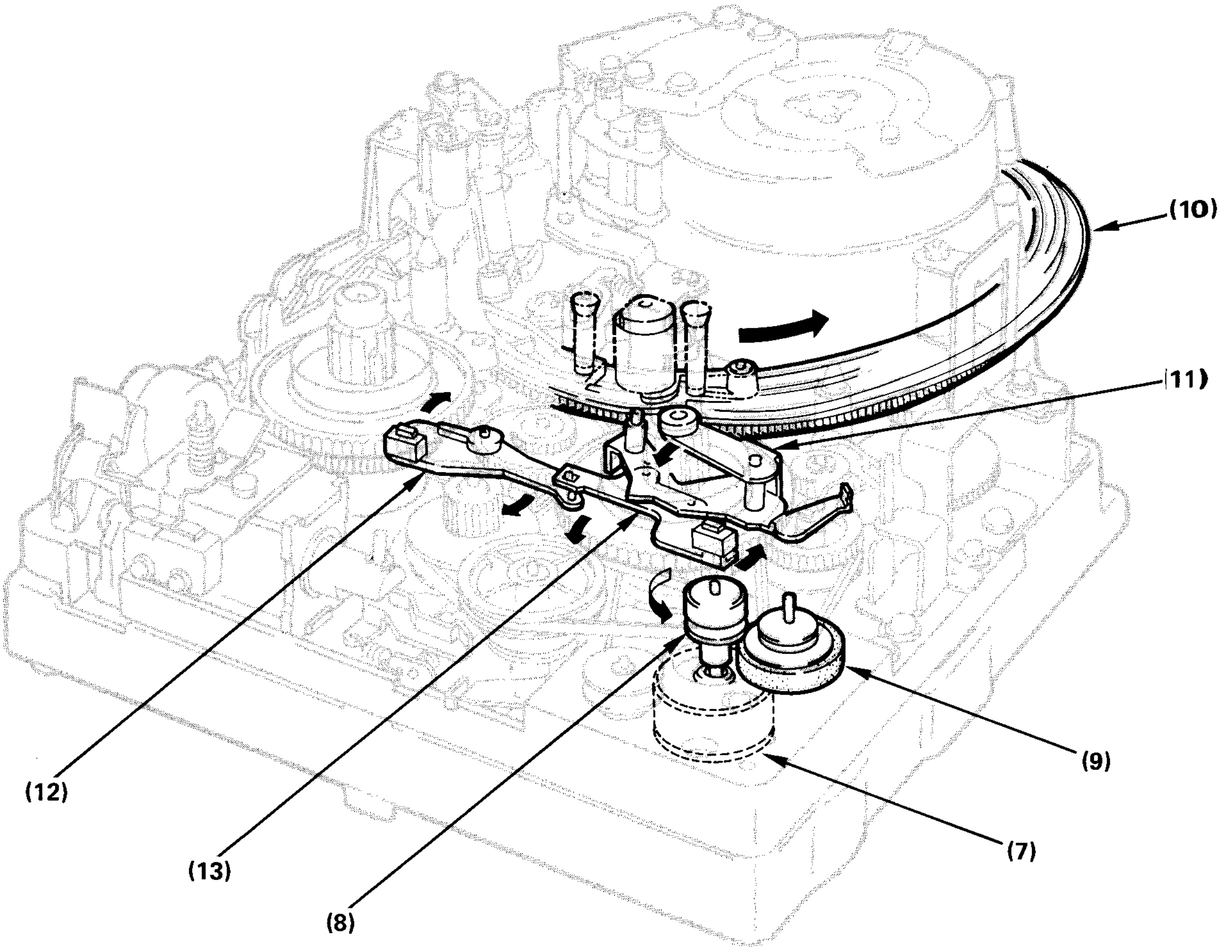


Fig. 3-33

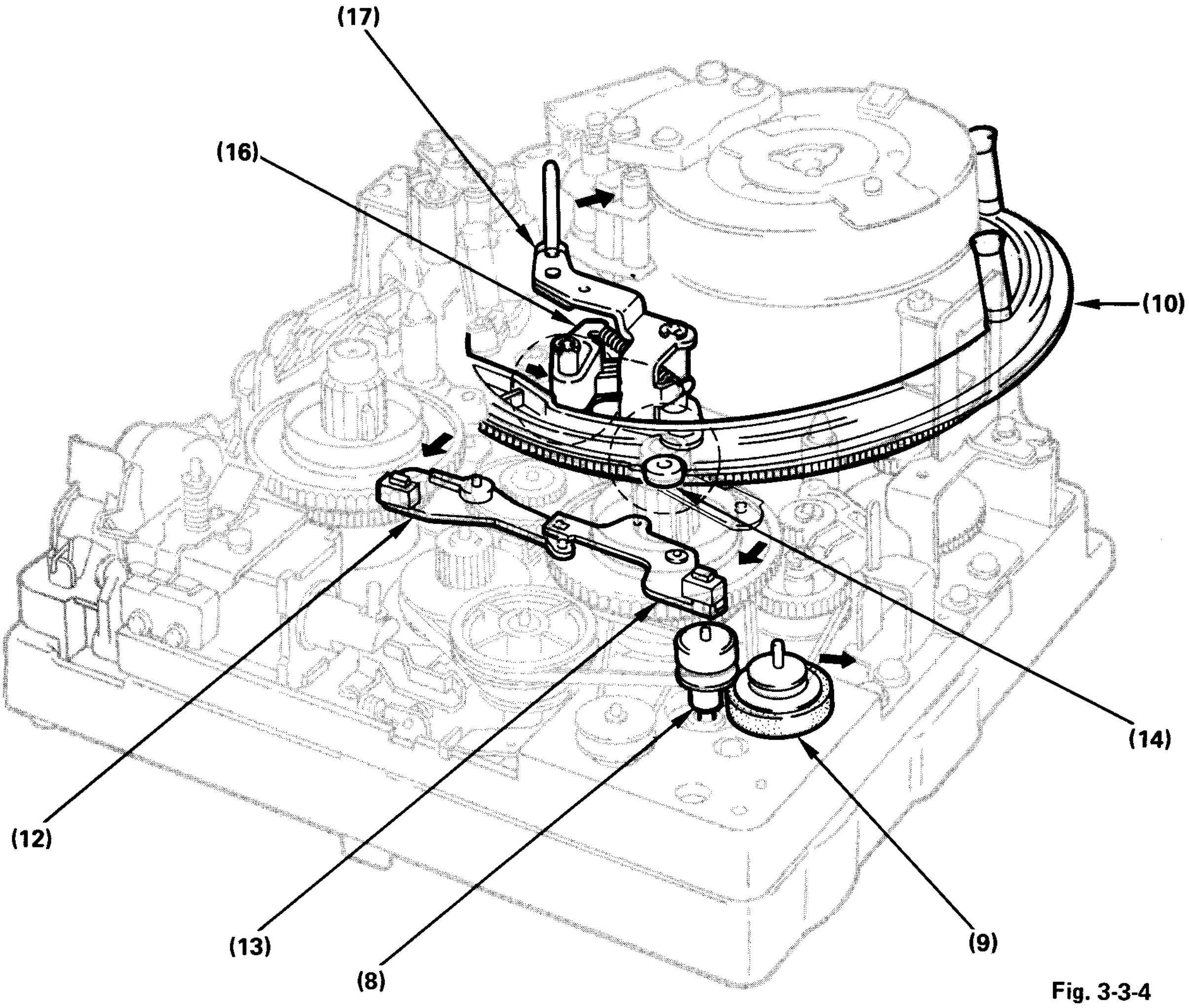
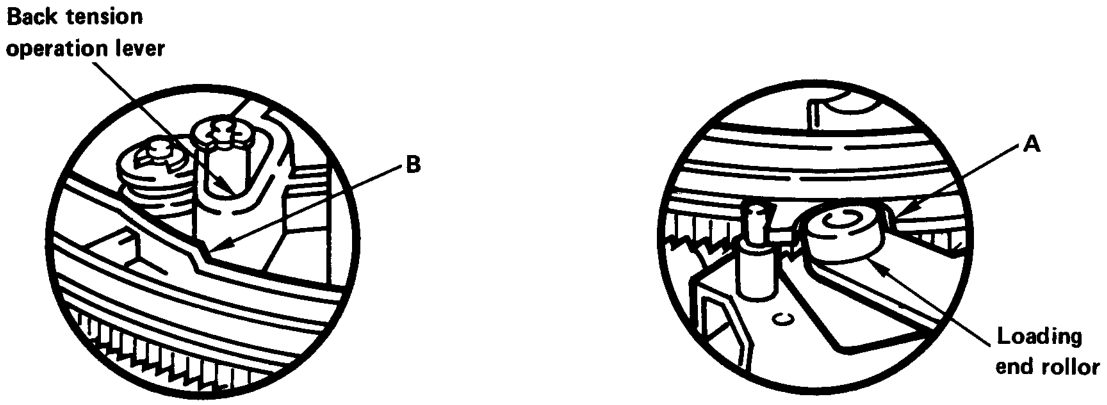

(17)
(16)
(10)
(14)
(12)
(13)
(8)
(9)

Fig. 3-3-4


Back tension operation lever
B
A
Loading end rollor

Cam B

Cam A

Fig. 3-3-5

2. Drive Path and Switching Direction of the Reel Bases in Each Mode

Before giving the explanation for each mode, an overall explanation of the drive paths and switching direction of the reel bases will be given.

Tape travel is driven at a constant speed by the capstan. There are two types of take-up. One is take-up at the reel base through the slip mechanism, and the other is take-up performed directly at the reel base, without passing through the slip mechanism. If take-up direction is dvided into the supply reel side and the take-up side, there are the following three drive paths.

a. Drive Path 1

Drive of the take-up reel through the slip mechanism (PLAY mode and REC mode).

b. Drive Path 2

Direct drive of the take-up reel (F FWD mode).

c. Drive Path 3

Direct drive of the supply reel (REW mode).

(1) Structure (Refer to Fig. 3-3-6 and Fig. 3-3-7.)

The reel drive paths are shown in Fig. 3-3-6 and Fig. 3-3-7. The idler gear (18) is installed on the idler support lever (19), and the idler support lever (19) can rock at its centre on the pivot (20). A centre gear (21) is installed on the pivot (20), and the centre gear (21) is driven by the second belt (23), through the relay pulley (22). The centre gear (21) is also engaged with the idler gear (18). The supply reel brake (12) and the take-up reel brake (13) at each reel base are engaged by the brake spring (24). The idler select lever (26), which supports the idler select link (25), is in contact with the C section of the supply reel brake (12). The spring coil (27) is hooked on the idler select lever (26), and always applies a anti-clockwise rotation force to the lever.

As for the idler select link (25), the long hole of the D section is in contact with the idler support lever (19).

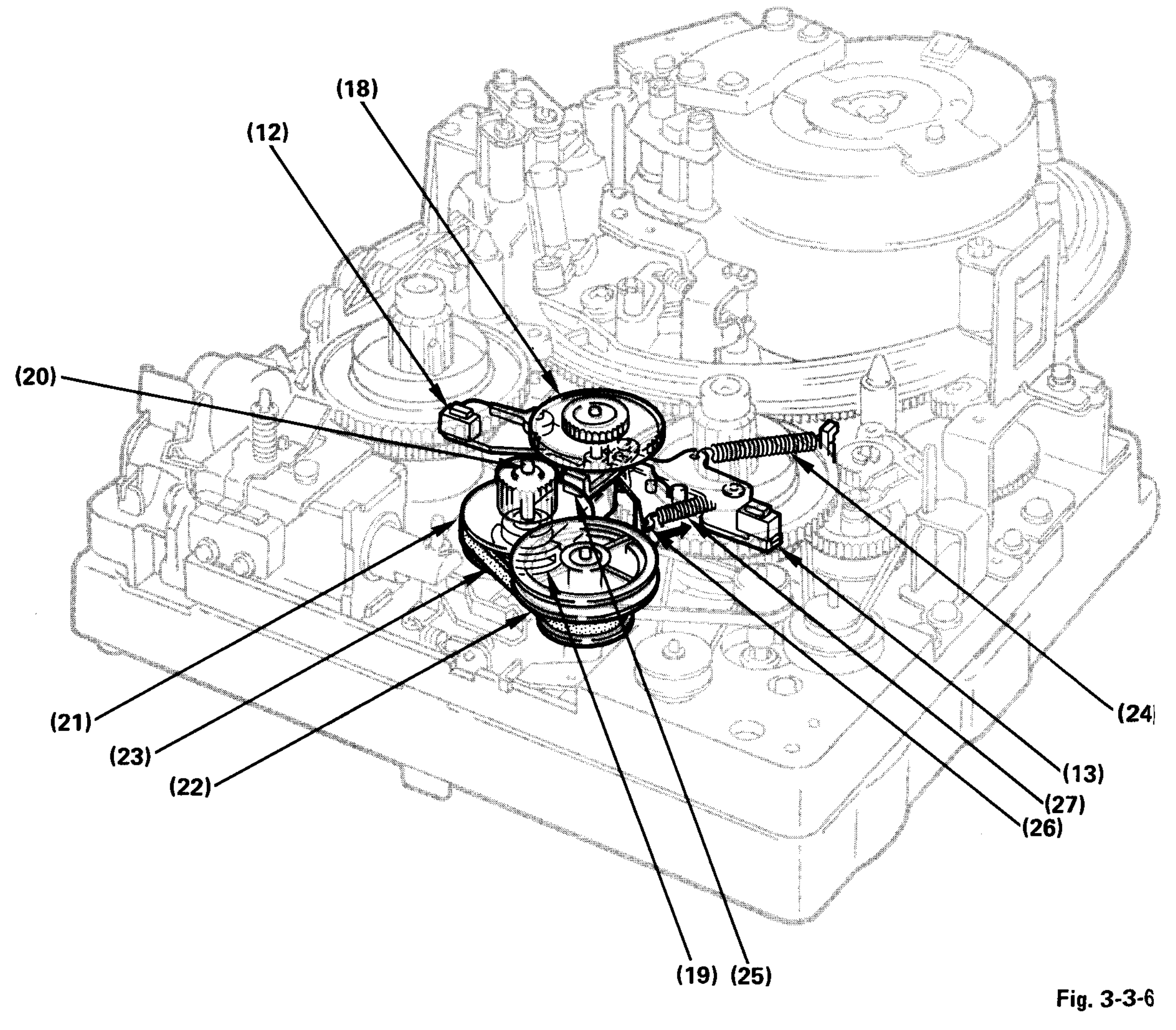


Fig. 3-3-6

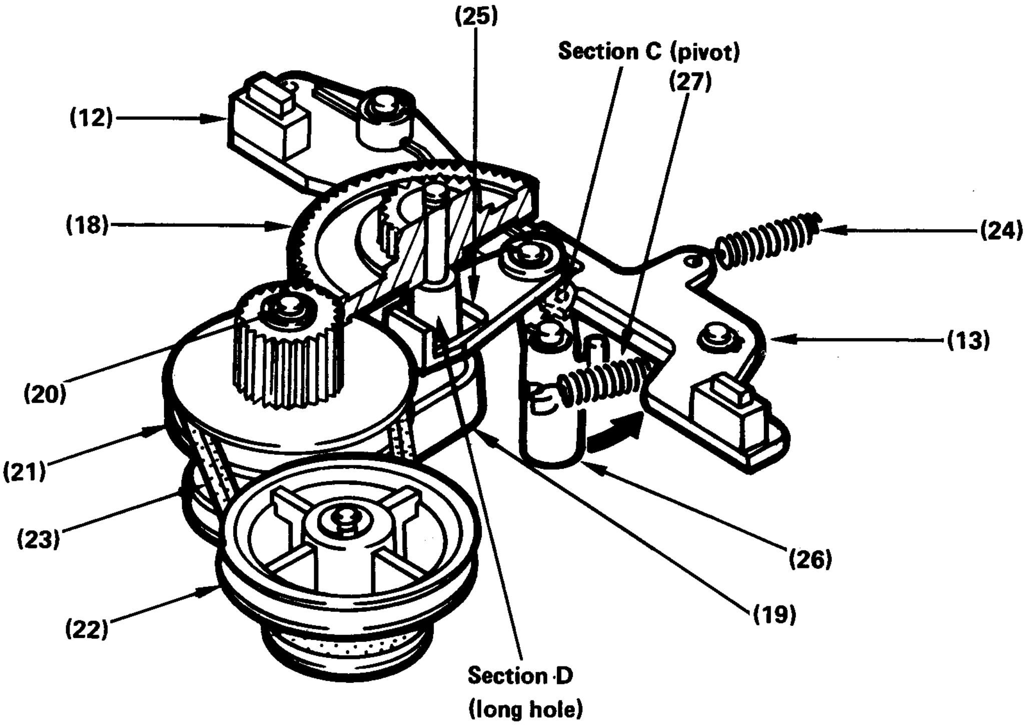


Fig. 3-3-7

(2) Operation (Refer to Figs. 3-3-8 ~ 3-3-12.)

Fig. 3-3-6 shows the conditions during the STOP mode, and, if from this state the supply reel brake (12) is released, the idler select lever (26) attempts to rotate anti-clockwise as shown in Fig. 3-3-8 and Fig. 3-3-9. Because of this, the tip of the idler select link (25), section E, is tightly connected to the second belt (23) looped around the centre gear (21). If the centre gear (21) rotates clockwise from this state, the idler select link (25) moves in the direction indicated by the arrow, and, therefore, the idler support lever (19) also moves clockwise. Until the idler select link (25) and the second belt (23) move away, when the idler support lever (19) rotates, it is rotated by the rotation force of the idler select lever (26) until it makes contact with the stopper (28). When it moves to this position, the idler gear (18) interlocks with the take-up reel gear (29).

In the same manner, if the rotation direction of the centre gear (21) is reversed, the idler gear (18) interlocks with the supply reel gear (30).

The above are the switching operations when winding the cassette tape onto the supply reel or onto the take-up reel.

In the next section, the switching operations of the reel drive through the slip mechnism and of direct dirve of the reel base are described.

As shown in Fig. 3-3-10, there are 2 gears each for the supply reel base and for the take-up reel base. When the upper gears are driven, it becomes a slip drive, and when the lower gears are driven, it becomes a direct drive. The vertical movement lever (31) is connected to the idler support lever (19); when the fast forward/rewind solenoid (32) is in the released state, section F of the idler gear (18) interlocks with the take-up reel slip gear (33); when the solenoid is activated, the idler support lever (19) and the idler gear (18) move downward, and section G and gear H interlock directly. (Refer to Fig. 3-3-11 and Fig. 3-3-12.)

As explained previously, reel drive paths 1 through 3 are switched by dividing the rotation direction and the height of the idler gear into two stages.

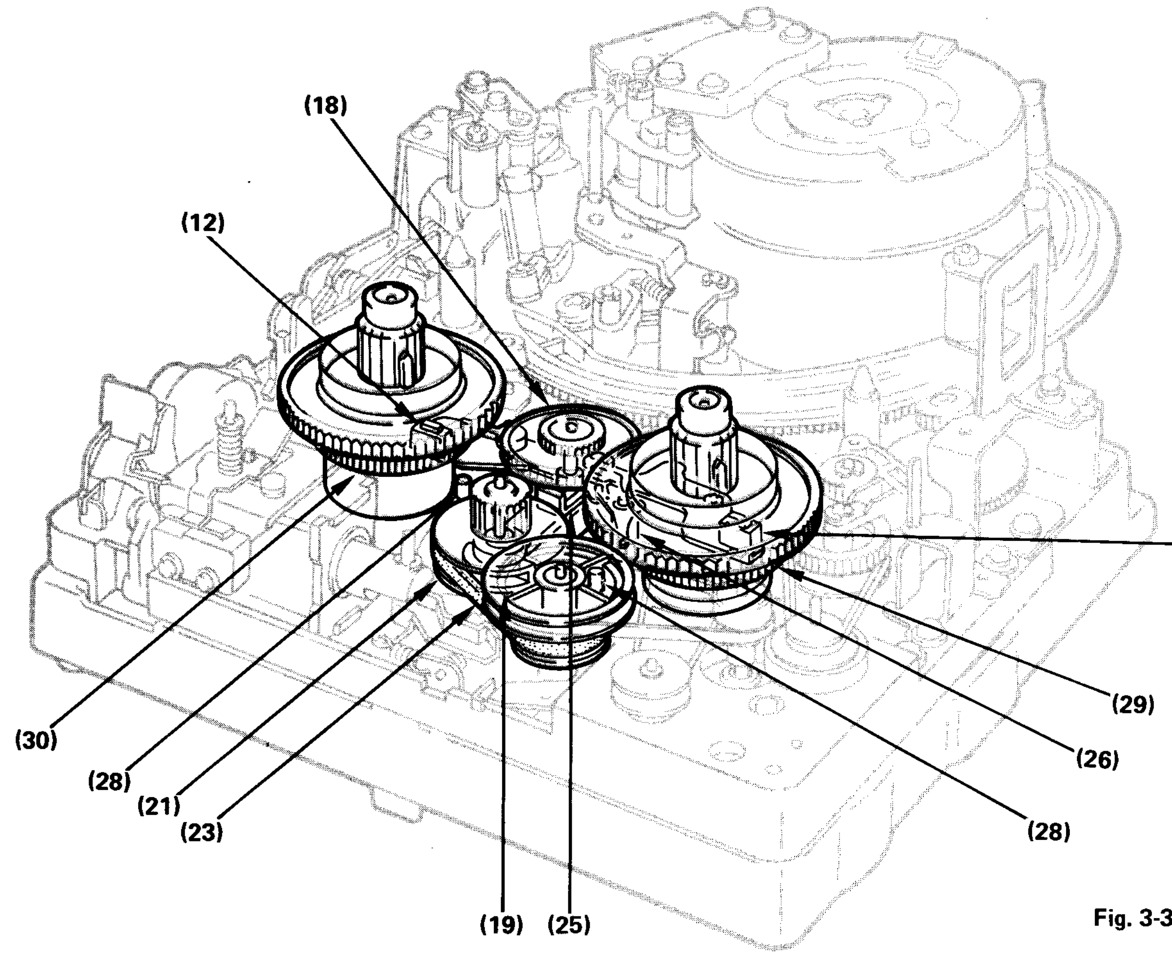

(18)
(12)
(13)
(29)
(26)
(28)
(30)
(28)
(21)
(23)
(19)
(25)

Fig. 3-3-8

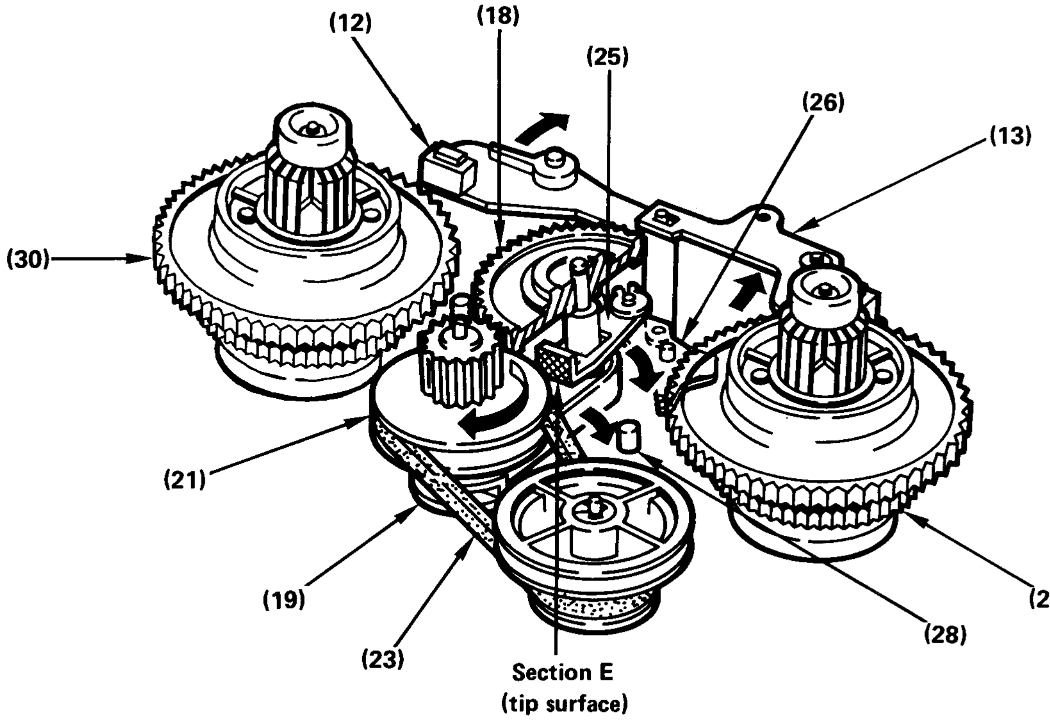

(12)
(18)
(25)
(26)
(13)
(30)
(21)
(19)
(23)
(29)
(28)
Section E
(tip surface)

Fig. 3-3-9

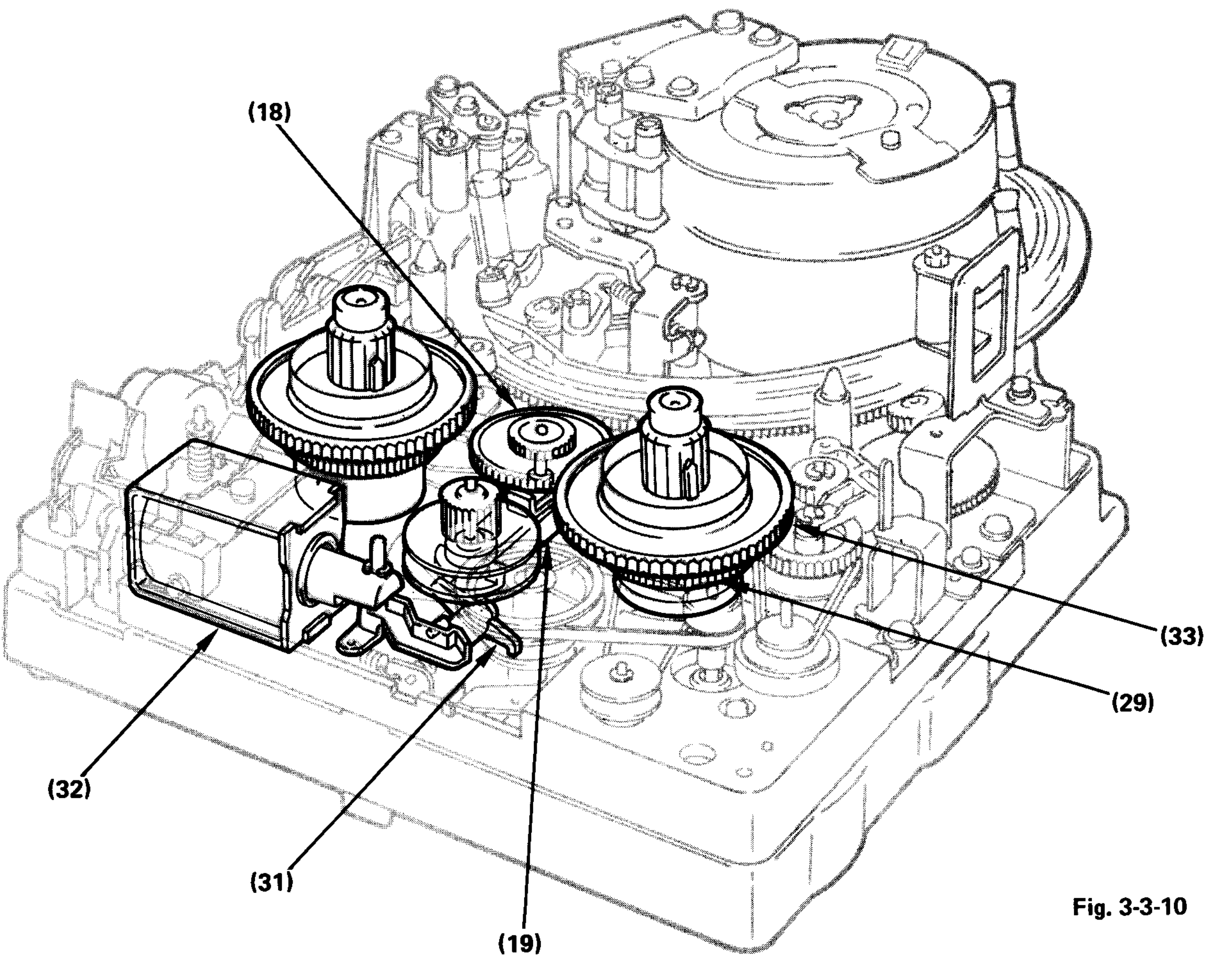

(18)
(33)
(29)
(32)
(31)
(19)

Fig. 3-3-10

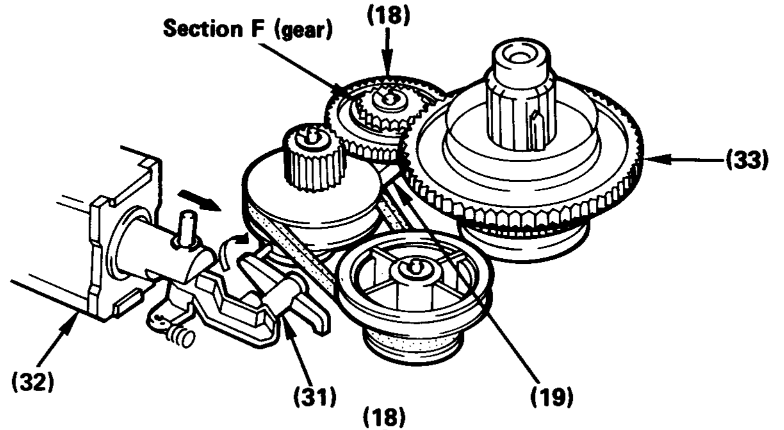

(19)
Section F (gear)
(18)
(33)
(32)
(31)
(19)

Fig. 3-3-11

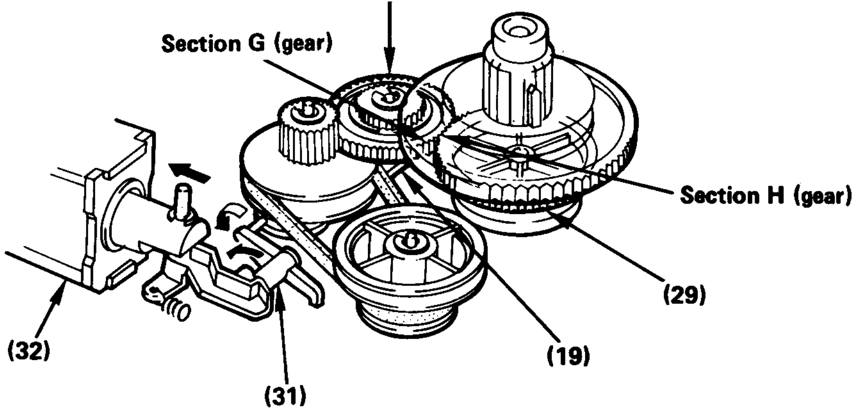

(18)
Section G (gear)
Section H (gear)
(29)
(32)
(19)
(31)

Fig 3-3-12

3. **PLAY Mode** (Refer to Fig. 3-3-13.)

a. Press the PLAY button.

b. The pinch roller pressure solenoid (34) is energized, the pinch roller pressure lever (35) turns in the direction indicated by the arrow, and the pinch roller (36) presses against the capstan (37).

c. Due to the turning motion of the pinch roller pressure lever (35), the brake release lever (play) (38) and the play release brake slide (39) move in the directions indicated by their respective arrows.

d. Due to the motion of the play release brake slide (39), the supply reel brake (12) and the take-up reel brake (13) are released.

e. Due to the release of the supply reel brake (12), the idler gear (18) operates. (Refer to item C-2. "rive Path and Switching Direction of the Reel Bases in Each Mode".)

f. The capstan turns, and tape movement begins.

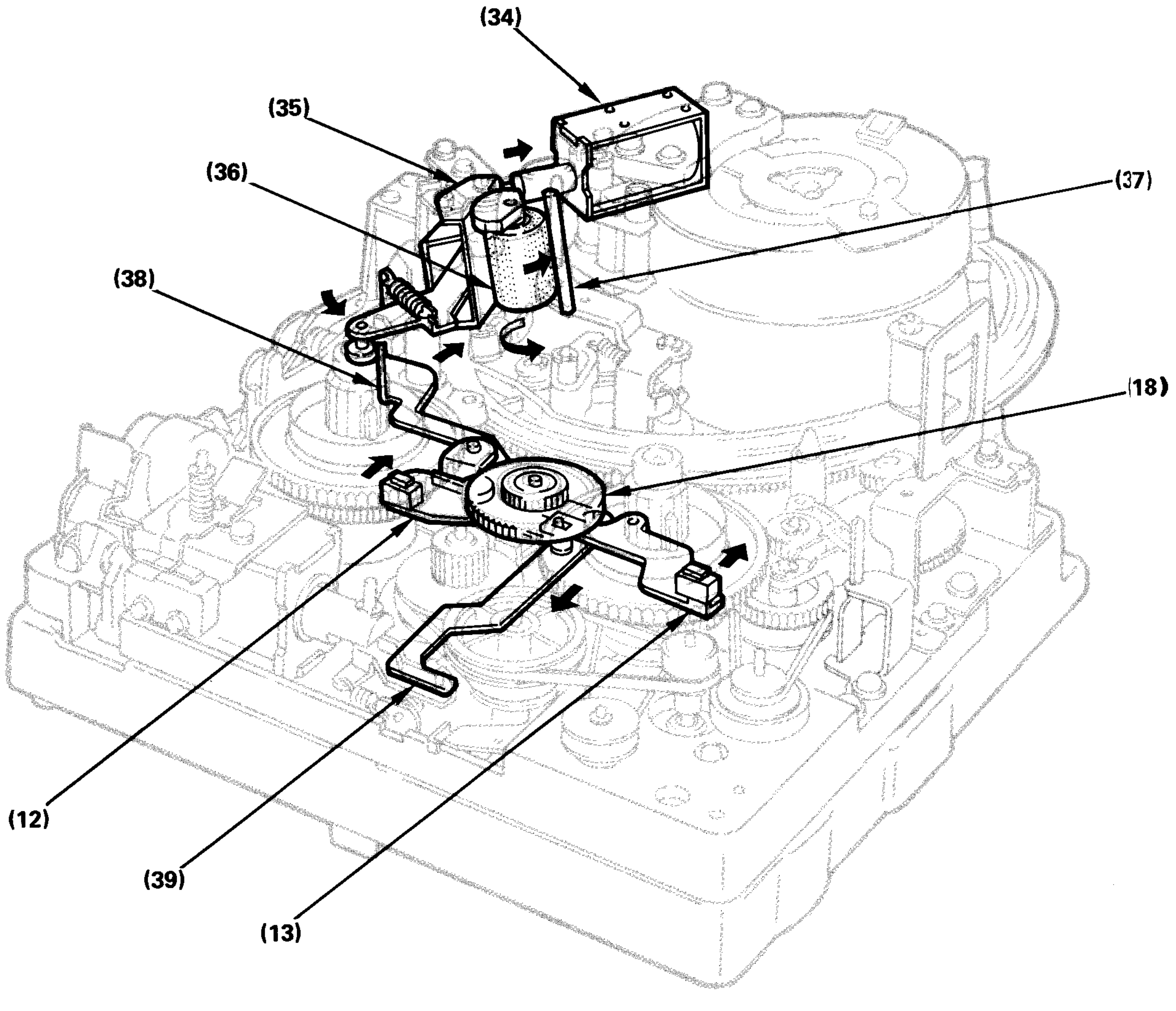


Fig. 3-3-1

4. **F FWD Mode** (Refer to Fig. 3-3-14.)

a. Press the F FWD button.

b. The fast forward/rewind solenoid (32) is activated, the back tension lever (17) is pushed back, the brake release lever (fast forward/rewind) (42) is released, and then the take-up reel brake (13) is released.

c. The reel motor pulley (8) turns clockwise, the idler gear (18) meshes with the take-up reel gear (29), and tape movement begins. (Refer to item C-2. "Drive Path and Switching Direction of the Reel Bases in Each Mode".)

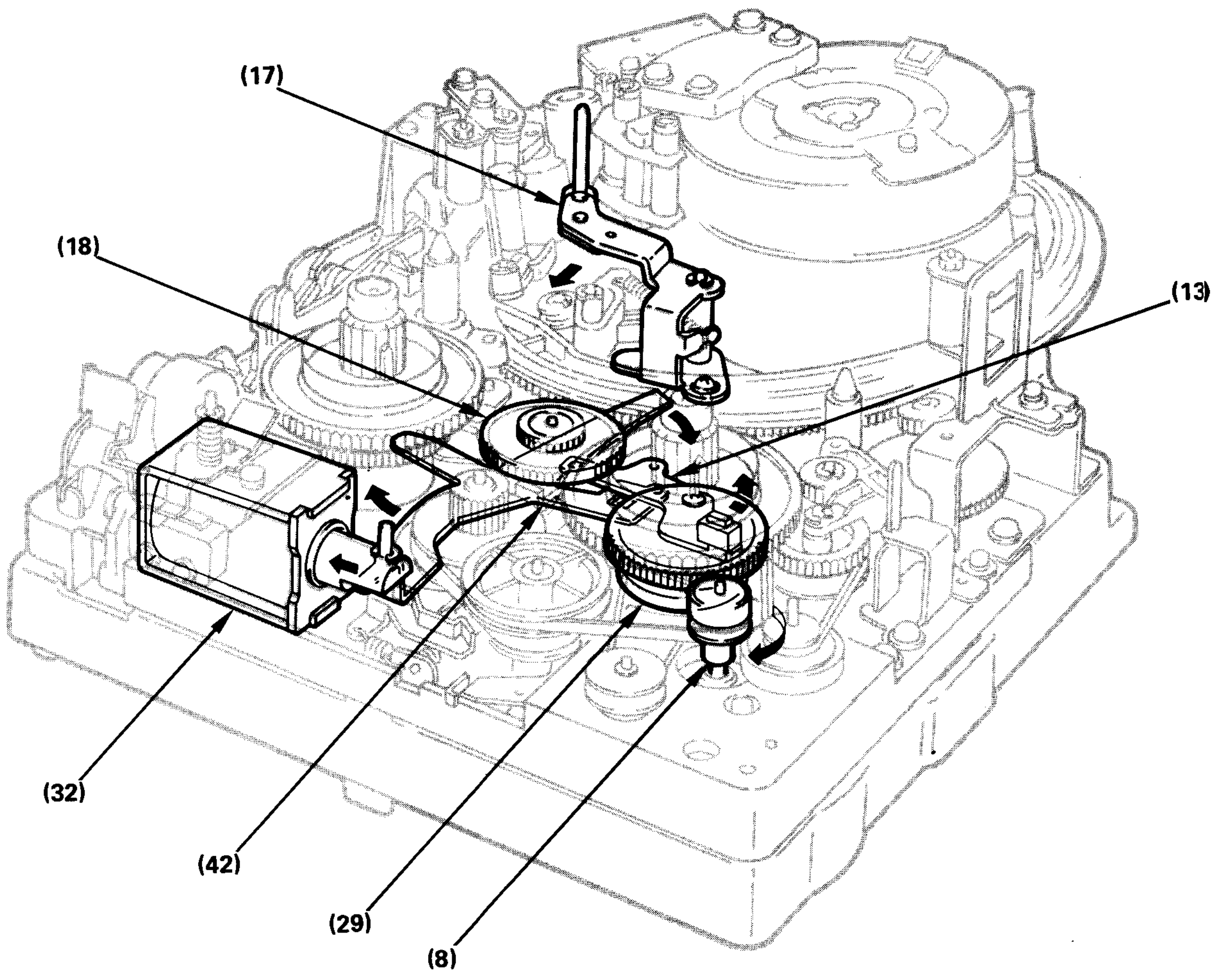


Fig. 3-3-14

5. **REW Mode** (Refer to Fig. 3-3-15.)

a. Press the REW button.

b. The fast forward/rewind solenoid (32) is activated. The back tension lever (17) is pushed back, the brake release lever (fast forward/rewind) (42) is released, and then the supply reel brake (12) is released.

c. The reel motor pulley (8) turns in the anti-clockwise direction, the idler gear (18) meshes with the supply reel gear (30), and tape movement begins.

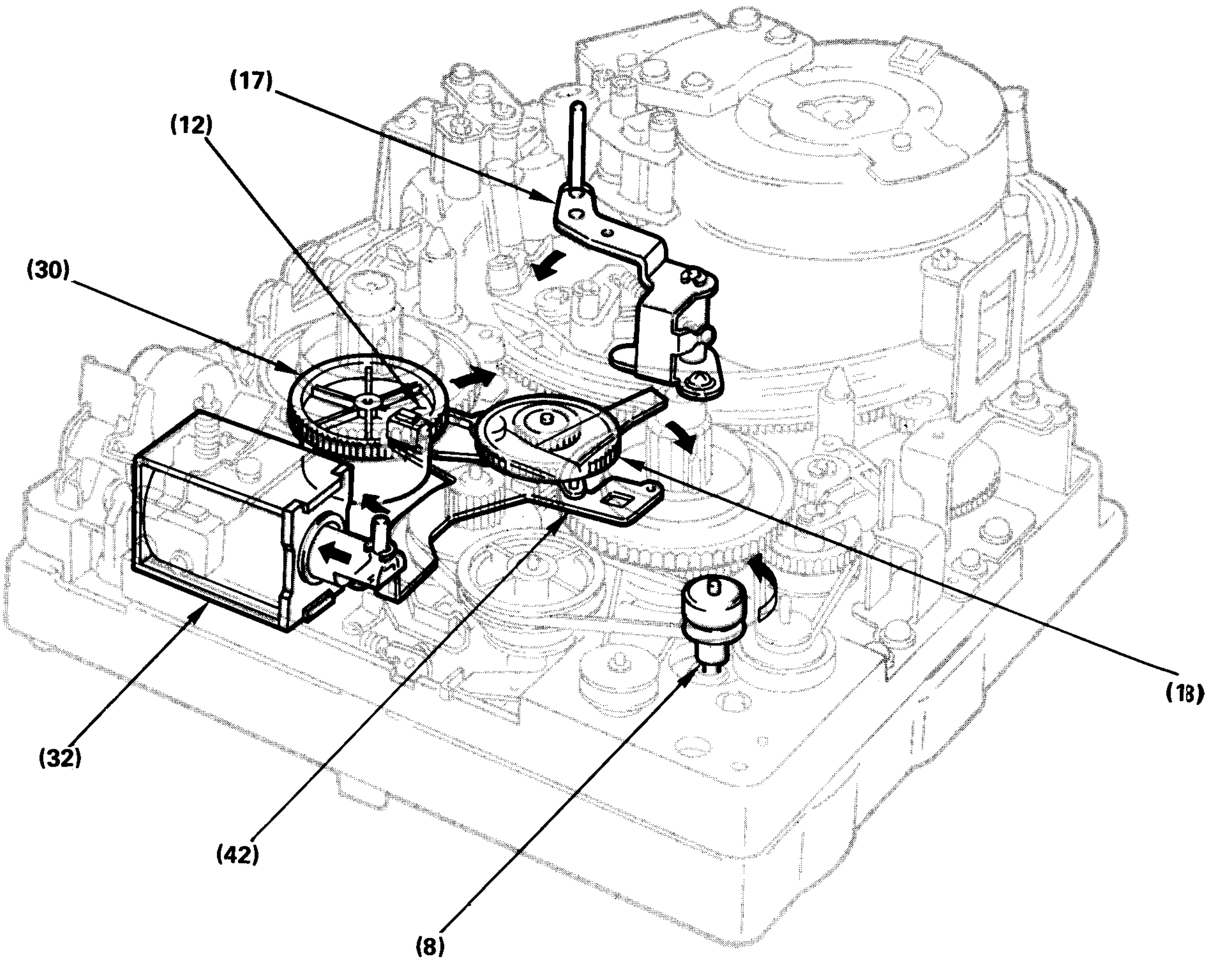


Fig. 3-3-15

6. REC Mode

a. Press the REC button. The REC mode is only operative when the erasure prevention tab of the video cassette has not been removed.

b. Mechanical operations are the same as during the PLAY mode. (Refer to item 3. "PLAY mode".)

7. PAUSE Mode (Refer to Fig. 3-3-16.)

a. From the PLAY mode or the REC mode, press the PAUSE button.

b. The pinch roller pressure solenoid (34) is released. The pinch roller (36) separates from the capstan (37), and, at the same time, the supply reel brake (12) and the take-up reel brake (13) are applied to each reel.

c. Tape movement stops, and the tape is in a waiting condition; all motors, however, continue to rotate.

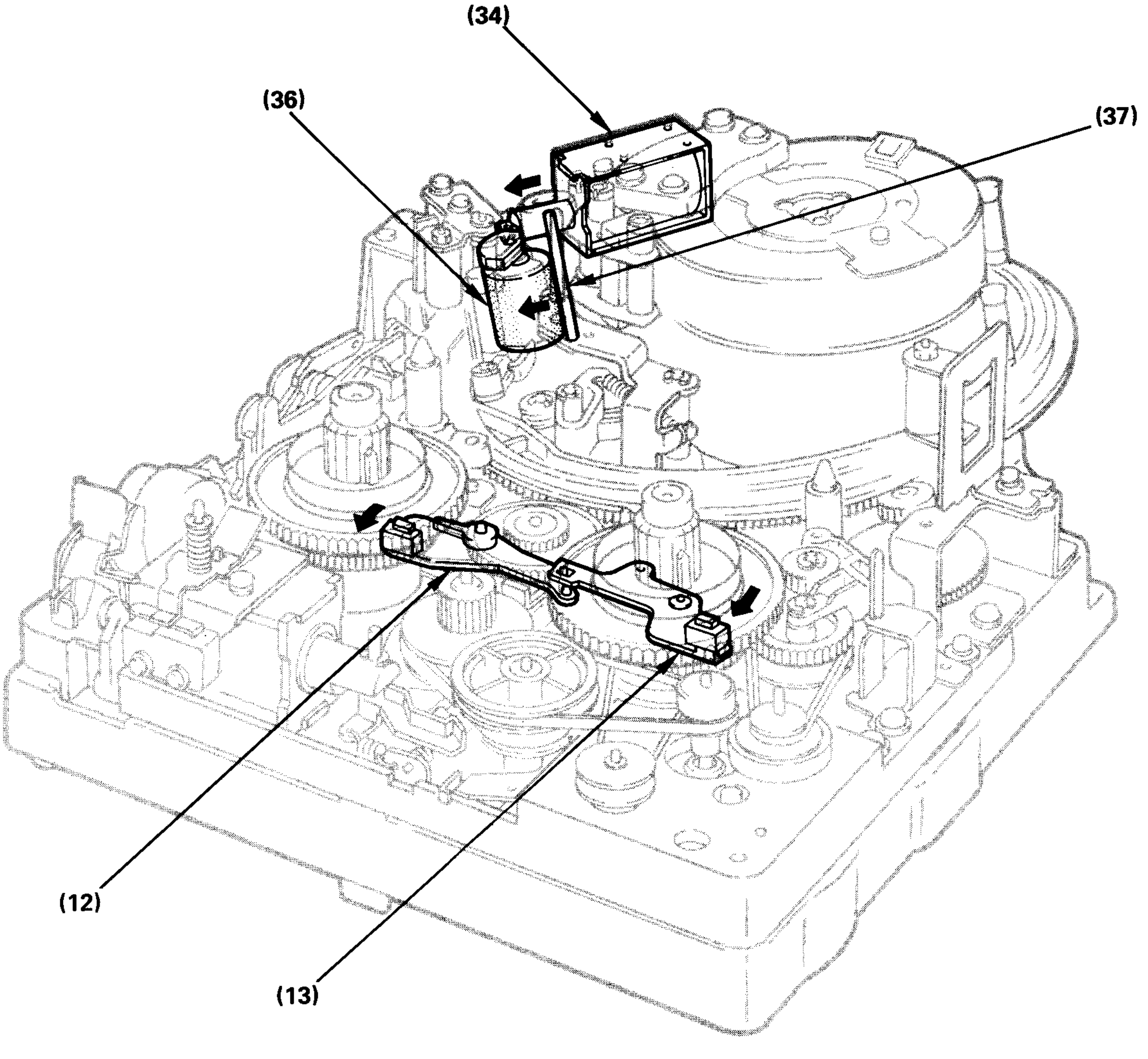


Fig. 3-3-16

8. **CASSETTE-UP Mode** (Refer to Figs. 3-3-17 ∼ 3-3-19.)

a. Press the EJECT button.

b. The capstan flywheel (43) turns in the direction indicated by the arrow, and, at the same time, the eject solenoid (44) is activated, and the eject roller (45) puts pressure on the perimeter of the capstan flywheel (43). (Refer to Fig. 3-3-17.)

c. The lever (46) moves the eject relay lever (47) in the direction indicated by the arrow. (Refer to Fig. 3-3-17.)

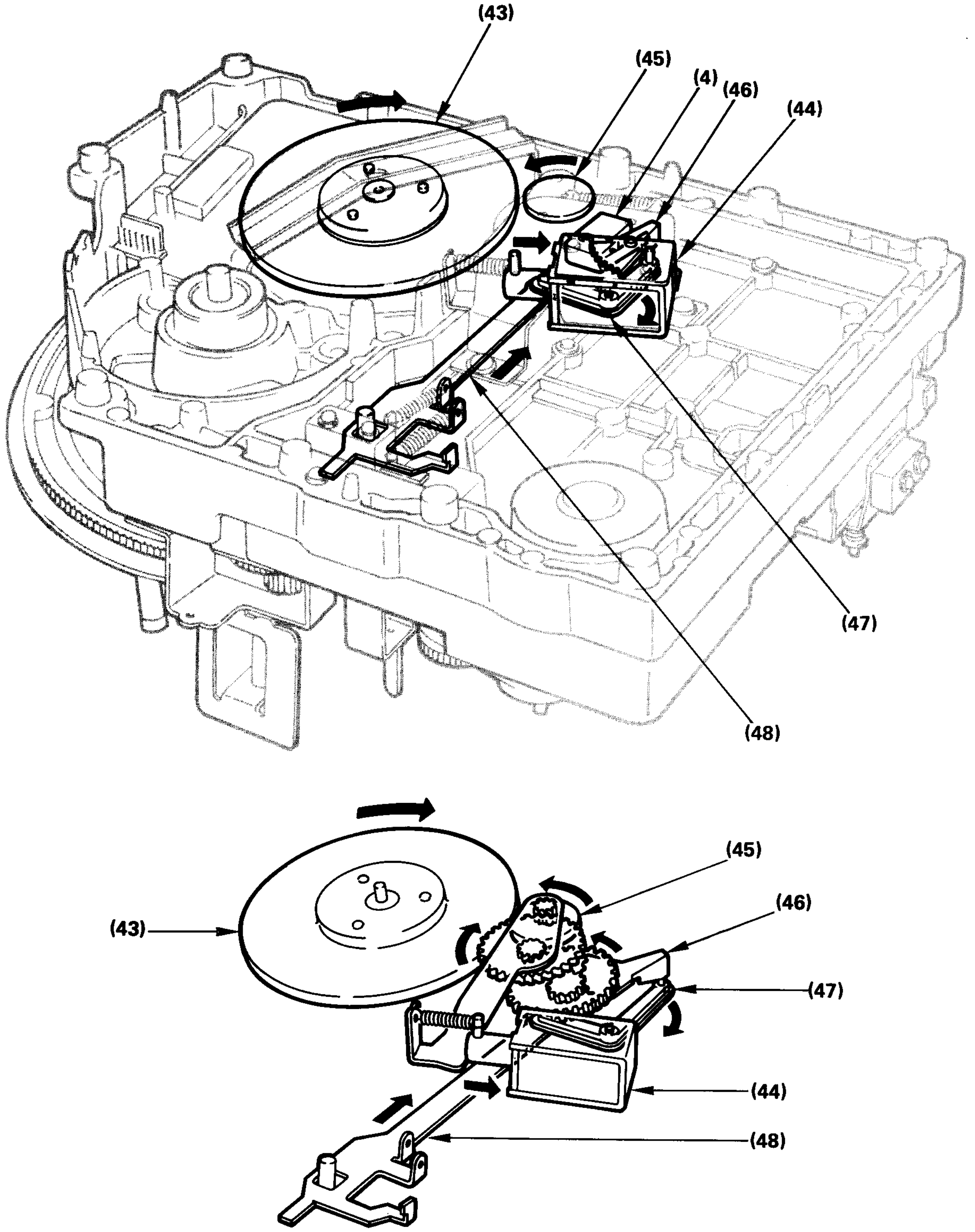


Fig. 3-3-7

d. The eject slide (48) moves with the eject relay lever (47) in the indicated direction, causing the loading end lever (11) to move, thereby breaking its connection to the loading ring (10). At the same time, the loading roller (9) puts pressure on the reel motor pulley (8). (Refer to Fig. 3-3-17 and Fig. 3-3-18.)

e. The eject lock lever (49) turns in the direction indicated by the arrow, holding the eject lever (50), and at the same time, eject switch II (51) switches ON. (Refer to Fig. 3-3-18.)

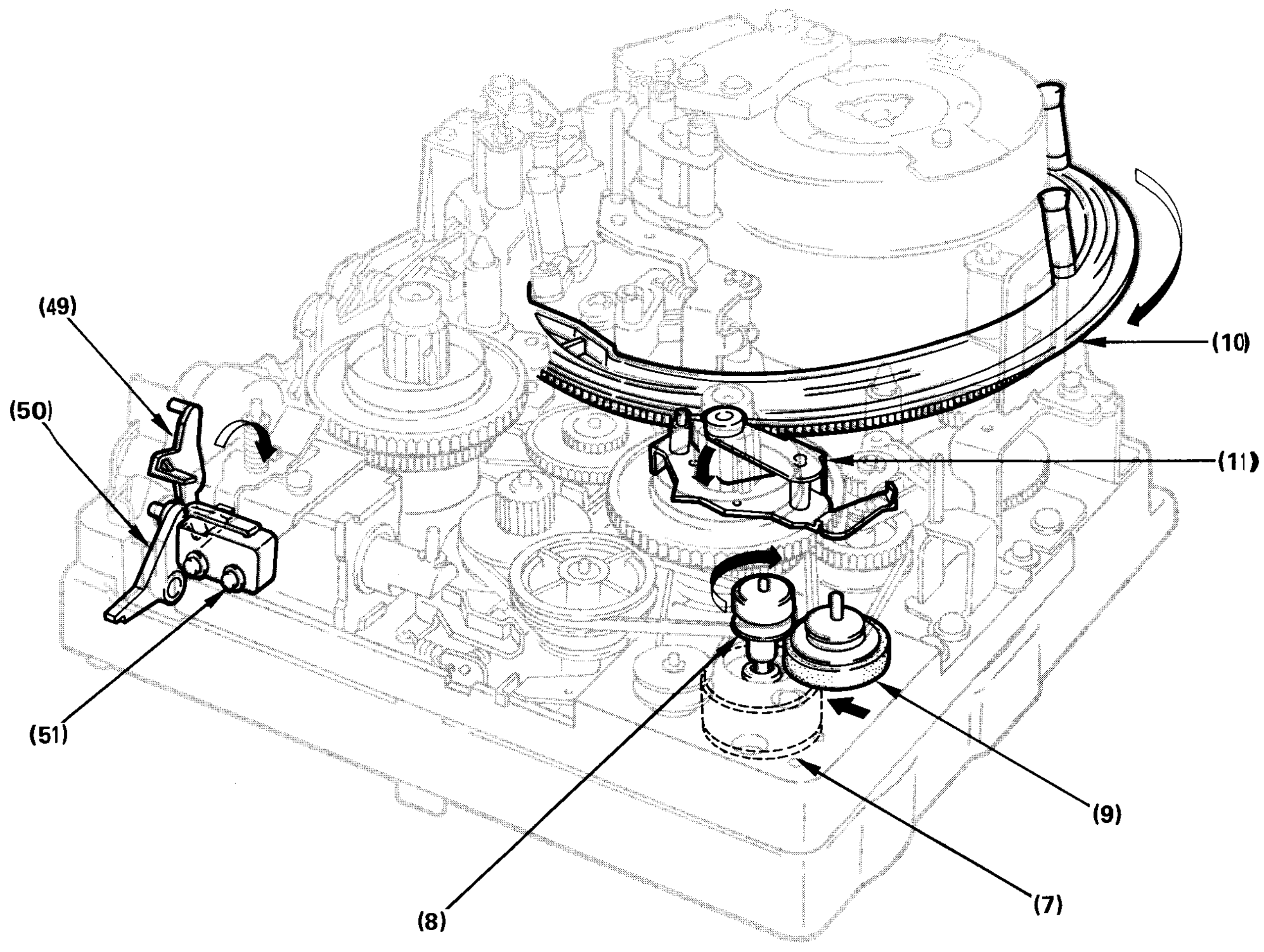


Fig. 3-3-18

f. The reel motor (7) and the loading ring (10) rotate in the clockwise direction, and unloading begins. Also, the eject solenoid (44) is released. (Refer to Fig. 3-3-18.)

g. At this time, the supply reel brake (12) and the take-up reel brake (13) are released, and the eject brake (52) is applied to the supply reel gear (30). (Refer to Fig. 3-3-19.)

h. When unloading is completed, the loading ring lock roller (53) moves in the direction indicated by the arrow, into the I section, the loading ring lock lever (6) is released, and the cassette moves up. At this time, the cassette switch (4) switches OFF. (Refer to Fig. 3-3-17 and Fig. 3-3-19.)

i. When the cassette holder is raised, the eject release lever (54) turns in the direction indicated by the arrow, the eject lock lever (49) is released, and the CASSETTE-UP mode is completed. (Refer to Fig. 3-3-19.)

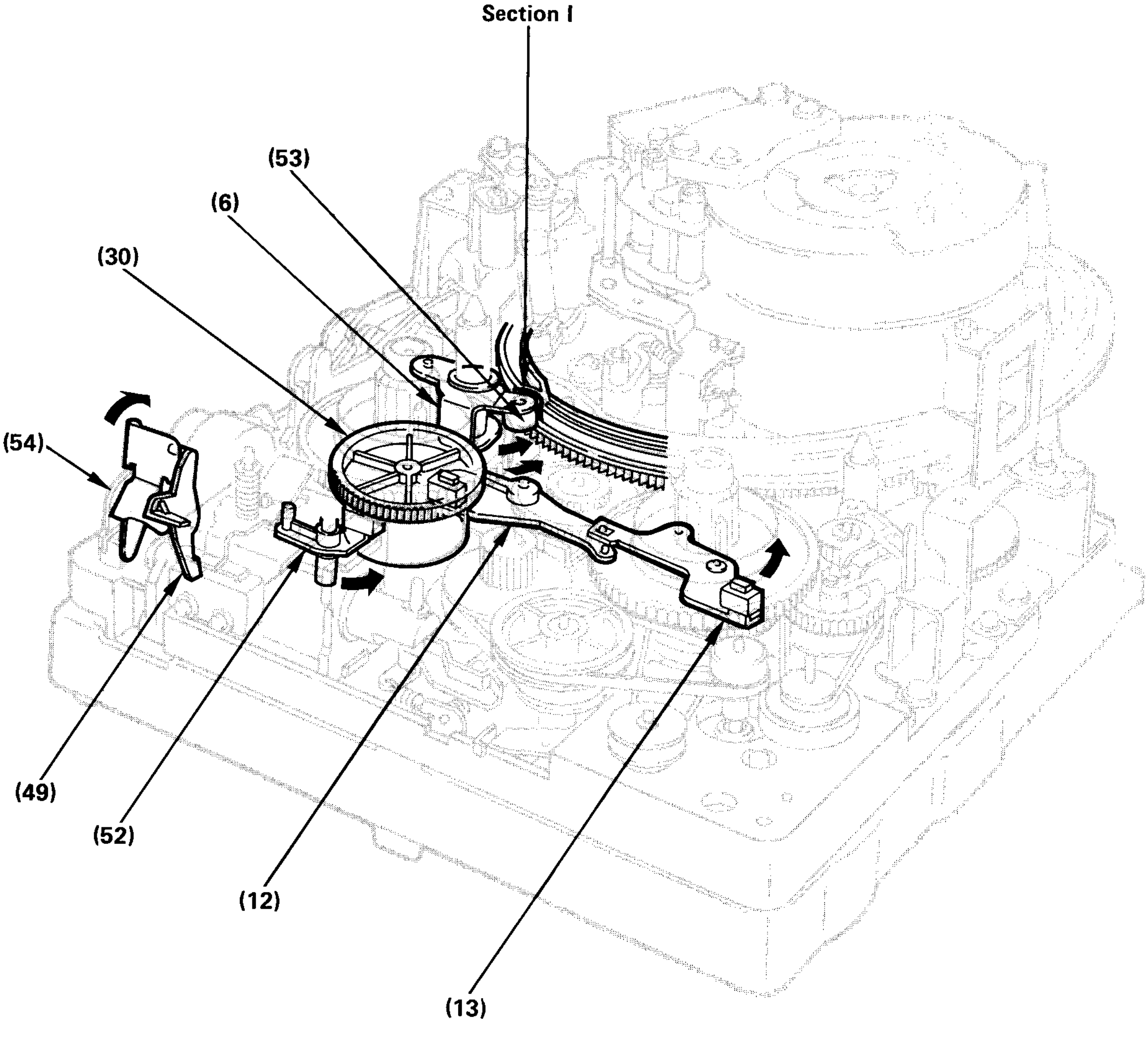


Fig. 3-3-19

PRODUCT SAFETY NOTICE

The components designated by a symbol (⚠) in this schematic diagram designates components whose value are of special significance to product safety. Should any component designated by a symbol need to be replaced, use only the part designated in the Parts List. Do not deviate from the resistance, wattage and voltage ratings shown.

PARTS LIST

ACCESSORIES

Ref. No.	Parts No.	Description
	143-6-411T-18200	Owner's Manual
	149-016-48	Cassette Tape, L-250
	4-243V-33101	Antenna Output Cable
	143-6-315T-01300	Accessories Box

NOTE: Parts order must contain Model Number, and Description.

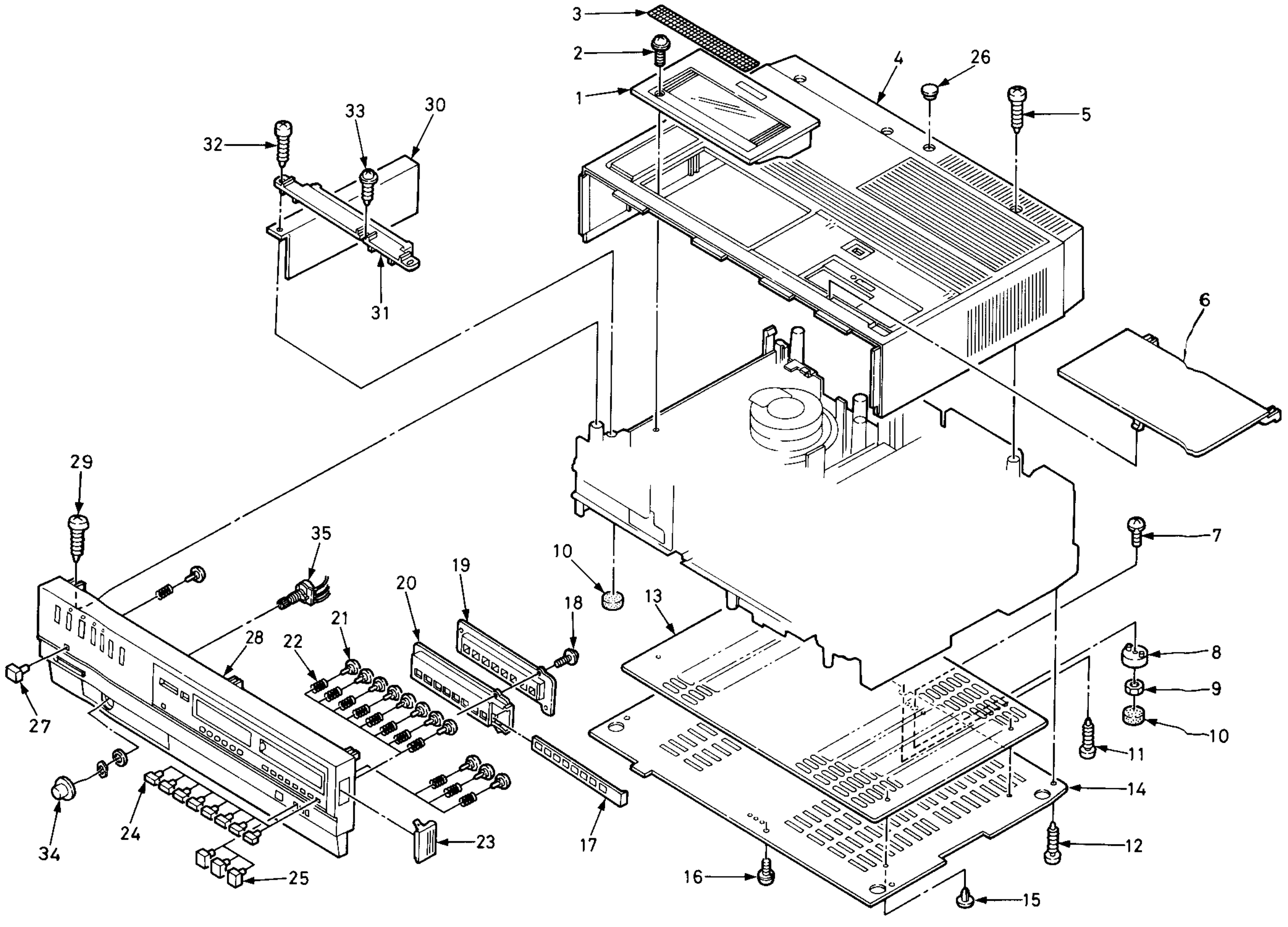
PACKING MATERIALS

Ref. No.	Parts No.	Description
	143-6-132T-13500	Individual Carton
	143-6-251T-01700	Ind. Polyethylene Cover
	143-6-144T-04100	Right Pad
	143-6-144T-04200	Left Pad
	143-6-316T-04700	Top Sheet, Protect for Steples
	143-6-316T-04600	Bottom Sheet
	143-6-331T-01800	Protector Sheet, Cassette Cover

CABINET PARTS

Ref. No.	Parts No.	Description
1	143-2-135T-16100	Cover, Cassette
2		Screw, Pan Hd., Machine, 3x6 mm, Z1
3	143-2-241T-02000	Veil, Cassette Cover
4	143-0-111T-01700	Cabinet
5		Screw, Pan Hd., Tapping, 4x20 mm, ZK
6	143-0-133T-00900	Channel Pre-set Compartment Lid
7		Screw, Pan Hd., Machine, 3x4 mm, Z1
8	143-2-174T-02000	Foot, Bottom Lid
9		Hex. Nut, 3 mm, Z1
10	143-2-174T-02400	Plastic Cushion (5 used)
11		Screw, Pan Hd., Tapping, 3x16 mm, ZK
12		Screw, Pan Hd., Tapping, 4x16 mm, ZK
13	143-2-327T-04500	Bottom Insuration Sheet
14	143-2-125T-03200	Bottom Lid
15	143-2-464T-06500	Fixer (4 used), Bottom Insuration Sheet
16		Screw, Pan Hd., Machine, 3x6 mm, ZK
17	143-0-236T-00400	Channel Indicator Panel with Indications
(17)	143-2-236T-01000	Channel Indicator Panel
(17)	143-2-289T-05000	Channel Indicator, 9 pcs.
18		Screw, Pan Hd., Tapping, 3x10 mm, Z1
19	143-2-365T-09200	Holder (B), Channel Indicator Panel
20	143-2-365T-09400	Holder (A), Channel Indicator Panel
21	143-2-464T-05700	Fixer, Operation Buttons
22	143-2-851T-53900	Spring Coil, Operation Buttons
23	143-2-133T-04100	Compartment Lid, Channel Indicator Panel
24	143-2-161T-10400	Channel Button
25	143-2-161T-12100	Push Button (3 used), POWER ON, OFF & TIMER
26	143-2-241T-02700	Rubber Cap, RF Channel Selector
27	143-2-161T-11800	REC LOCK Button
28	143-0-122T-02400	Front Panel
29		Screw, Pan Hd., Tapping, 4x20 mm, Z1
30	143-2-327T-04800	Insurator, SV-1 PCB.
31	143-2-241T-01400	Mechanism Cover
32		Screw, Pan Hd., Tapping, 4x16 mm, Z1
33		Screw, Pan Hd., Tapping, 3x16 mm, Z1
34	143-2-163T-02700	Tracking Control Knob
35	4-222V-14100	Tracking Control VR.

NOTE: Parts order must contain Model Number, and Description.

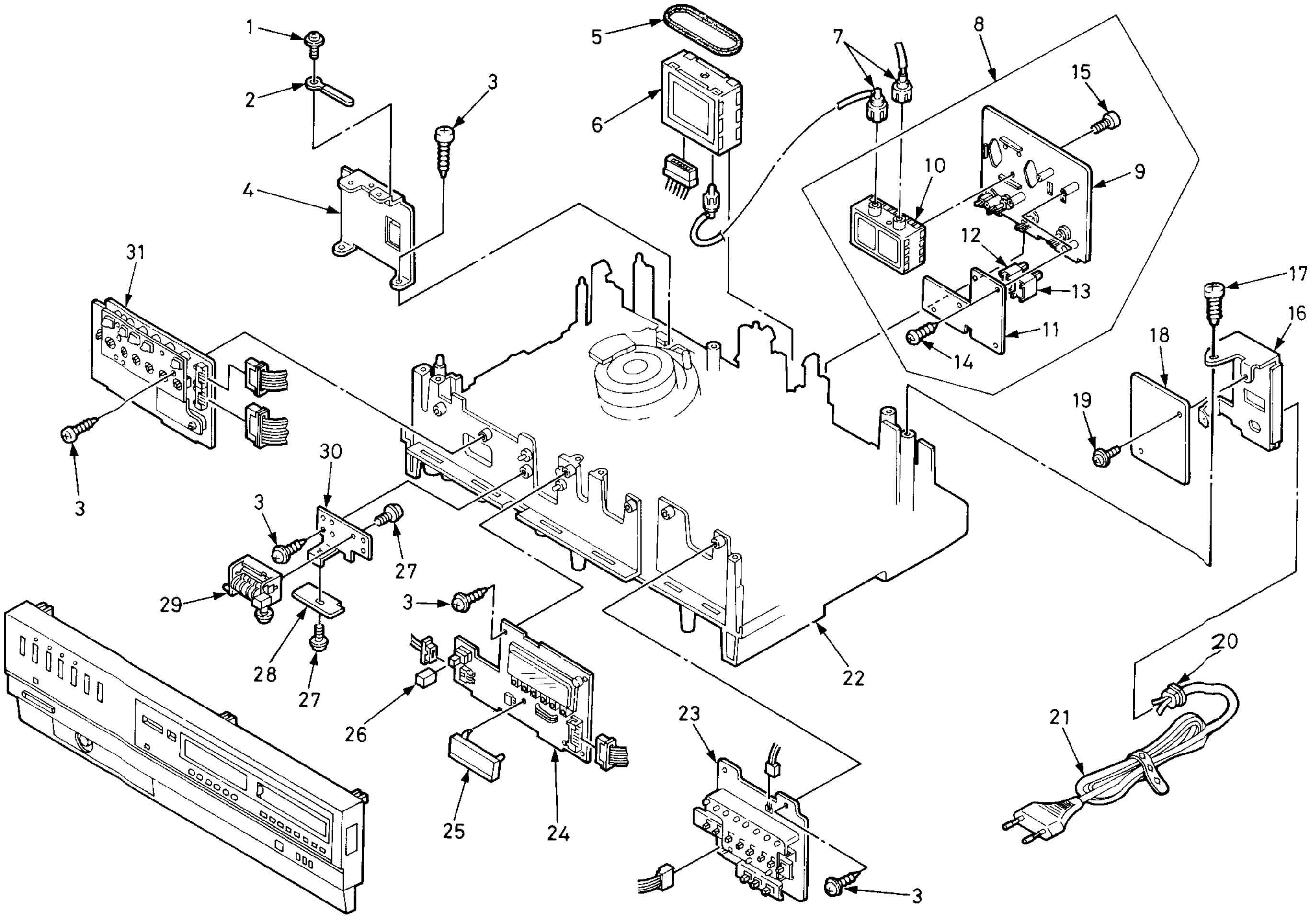


FRONT CONTROL & REAR TERMINAL PARTS

Ref. No.	Parts No.	Descritpion
1		Screw, Washer Hd., Machine(TP Screw), 3x6 mm, Z1
2	141-2-472T-01201	Lug, Wire Clamper
3		Screw, Pan Hd., Tapping, 3x10 mm, Z1
4	143-2-351T-47200	Bracket, Mechanism Grounding
5	143-2-564T-02900	Square Belt, Protect for RF Convertor
6	143-9-4300-44700	RF Convertor
7	4-243V-35902	RF-RF Connector Cable (2 used)
8	143-0-237V-00401	Antenna Terminal Board Assembly
9	4-237V-15900	Antenna Terminal Board
10	4-115V-15200	Antenna Booster
11	4-226V-85500	P.C. Board, Antenna Terminal
12	4-231V-19900	Slide Switch, TEST SIGNAL ON/OFF
13	4-231V-19800	Slide Switch, TUNER/EXT. IN
14		Screw, Pan Hd;. Tapping, 3x8 mm, Z1
15		Screw, Binding Hd., Machine, 3x6 mm, ZK
16	143-2-367T-04001	Bracket, Power Cord
17		Screw, Pan Hd., Tapping, 4x16 mm, Z1

Ref. No.	Parts No.	Description
18	143-9-0500-04200	PW-2 Circuit Board Assembly, AC. Power Supply
19		Screw, Washer Hd., Tapping, 3x6 mm, Z1
20	143-2-464T-02700	Fixer, Power Cord
21	⚠4-243V-12710	Power Cord
or	⚠4-243V-13900	Power Cord
22	143-2-312T-06100	Main Chassis
23	143-9-0600-03300	TN-3 Circuit Board Assembly, Channel Select
24	143-9-0700-04200	TM-1 Circuit Board Assembly, Timer
25	143-2-351T-47200	Protector, TM-1 PCB.
26	143-2-161T-10700	MEMORY ON/OFF Button
27		Screw with Spring & Flange Washer, Pan Hd., Machine, 3x6 mm, Z1
28	143-9-1300-00200	MC-1 Circuit Board Assembly, Counter
29	143-2-811T-00900	Counter
30	143-2-812T-02700	Bracket, Counter
31	143-9-0300-05000	SY-2 Circuit Board Assembly, Control

NOTE: Parts order must contain Model Number, and Description.

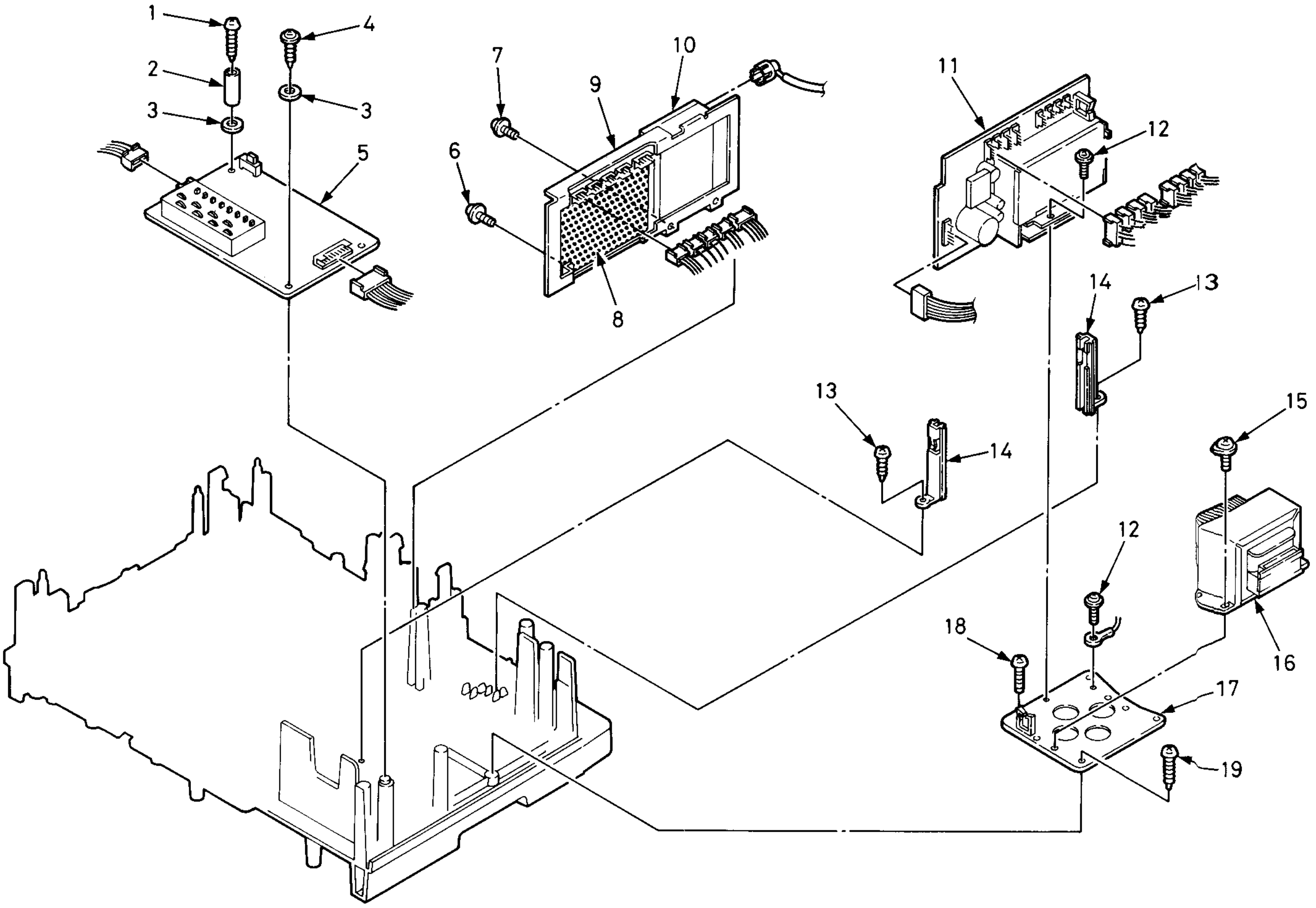


RIGHT SIDE PCB's PARTS

Ref. No.	Parts No.	Description
1		Screw, Pan Hd., Tapping, 3x25 mm, Z1
2	143-2-461T-03300	Reinforcement Pipe, Cabinet
3	141-2-453T-01700	Fiber Washer, 3x10x1 mm
4		Screw, Washer Hd., Tapping, 3x16 mm, Z1
5	143-9-0600-03200	TN-2 Circuit Board Assembly, Channel Pre-set
6		Screw, Wasner Hd., Machine(TP-S tight), 3x8 mm, Z1
7		Screw, Washer Hd., Machine(TP-S tight), 3x6 mm, Z1
8	143-9-0600-03100	TN-1 Circuit Board Assembly, IF.
9	143-2-312T-07900	Frame, Tuner & TN-1 PCB.
10	4-115V-14400	Tuner

Ref. No.	Parts No.	Description
11	143-9-0500-04100	PW-1 Circuit Board Assembly, DC. Power Supply
12		Screw, Washer Hd., Machine(TP Screw), 3x6 mm, Z1
13		Screw, Pan Hd., Tapping, 4c8 mm, Z1
14	143-2-377T-12200	Bracket, PCB.
15		Screw, Washer Hd., Machine(TP Screw), 4x8 mm, Z1
16	⚠ 4-251V-22100	Power Transformer
or	⚠ 4-251V-22200	Power Transformer
17	143-2-371T-00400	Bracket, Power Transformer
18		Screw, Pan Hd., Machine, 4x18 mm, Z1
19		Screw, Pan Hd., Tapping, 4x16 mm, Z1

NOTE: Parts order must contain Model Number, and Description.

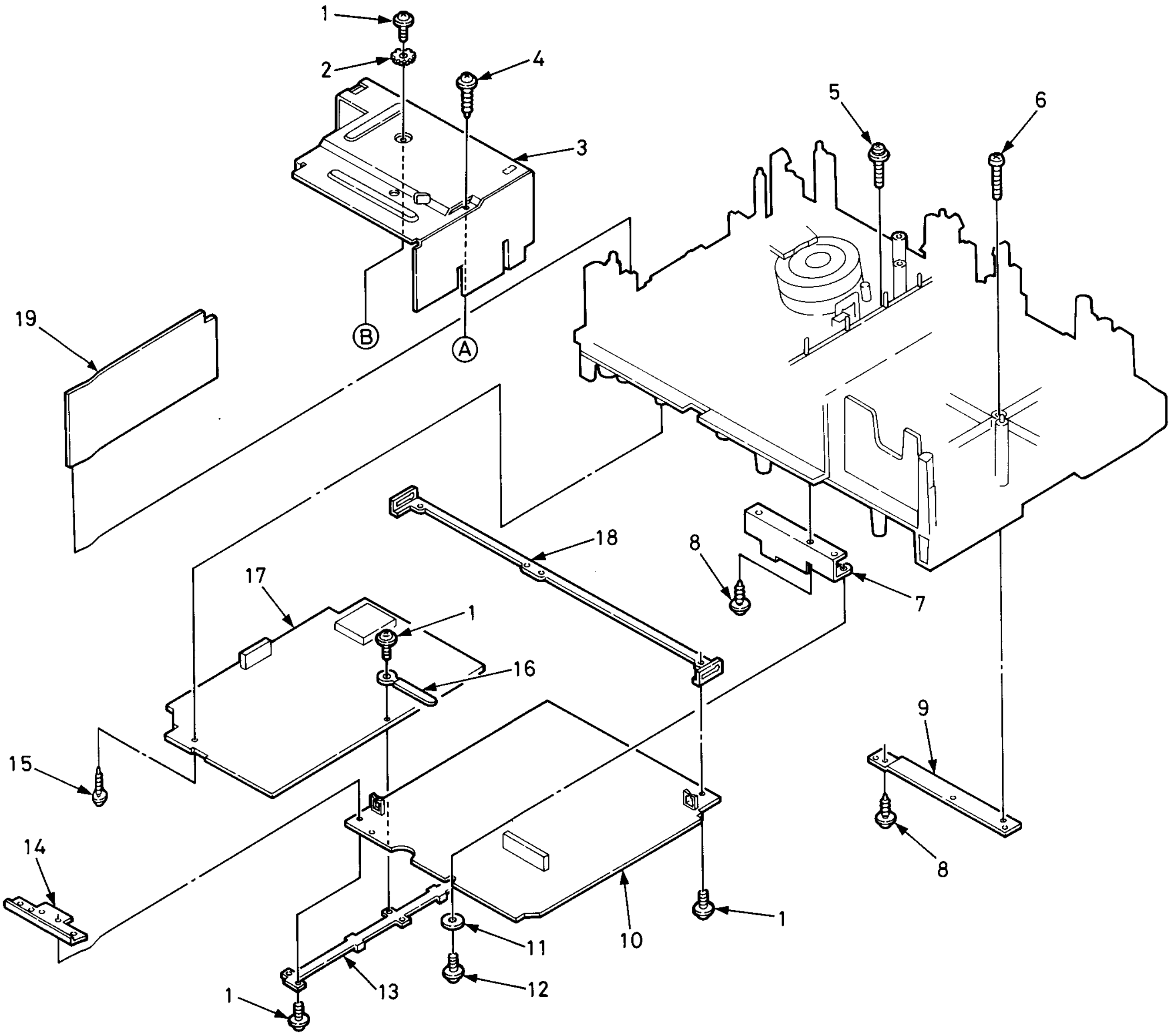


BOTTOM & LEFT SIDE PCB's PARTS

Ref. No.	Parts No.	Description
1		Screw, Washer Hd., Machine (TP Screw), 3x6 mm, Z1
2		Lock Washer, External Toothed, 3 mm, Z1
3	143-0-322T-01900	Shield Plate, Top
4		Screw, Pan Hd., Tapping, 4x16 mm, Z1
5		Screw with Spring & Flange Washer, Pan Hd., Machine, 4x20 mm, Z1
6		Screw, PanHd., Machine, 4x20 mm, ZK
7	143-2-351T-42600	Bracket, PCB.
8		Screw, Pan Hd., Tapping, 3x10 mm, Z1
9	143-2-351T-42700	Grounding Plate, Mechanism
10	143-9-0100-03400	VD-2 Circuit Board Assembly, Video & System Control

Ref. No.	Parts No.	Description
11	141-2-453T-01700	Fiber Washer, 3x10x1 mm
12		Screw, Washer Hd., Machine (TP Screw), 3x6 mm, ZR
13	143-2-377T-12400	Bracket (B), PCB.'s Joiner
14	143-2-377T-13800	PCB. Bracket, Reinforcement
15		Screw, Pan Hd., Tapping, 4x16 mm, ZR
16	141-2-472T-01201	Lug, Wire Clamper
17	143-9-0100-03300	VD-1 Circuit Board Assembly, Video, Video Pre-amp. & Audio
18	143-2-377T-12300	Bracket (A), PCB. Shaft
19	143-9-0400-03300	SV-1 Circuit Board Assembly, Servo

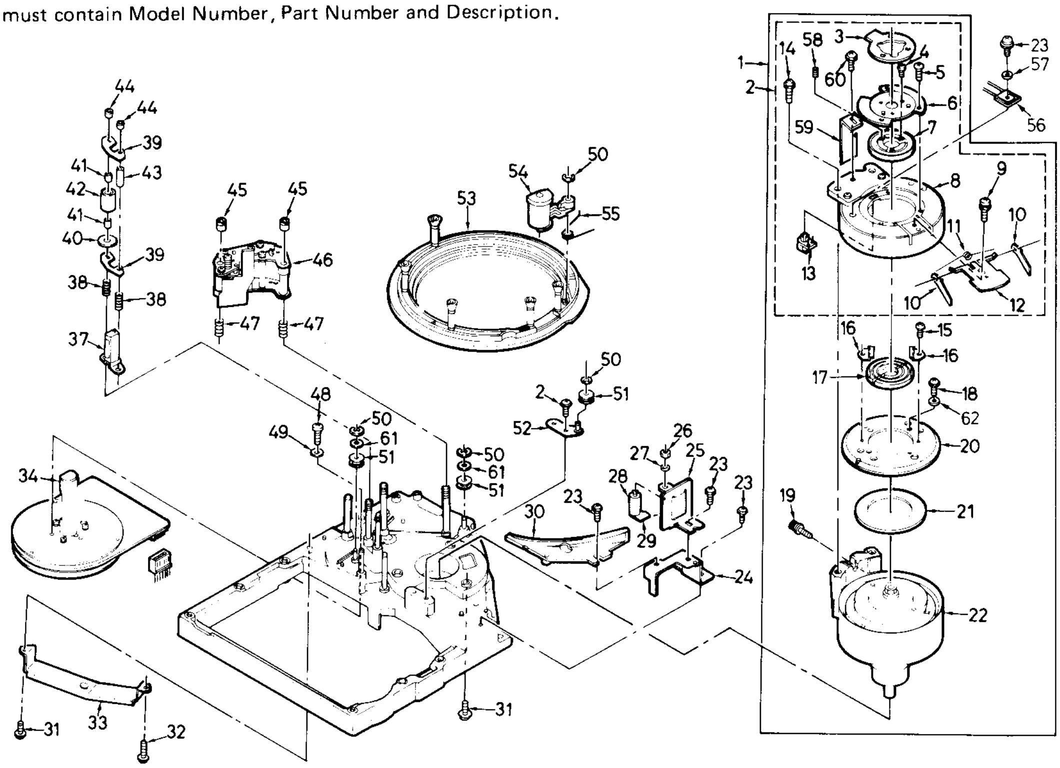
NOTE: Parts order must contain Model Number, and Description.



DRUM, CAPSTAN & PINCH ROLLER PARTS

Ref. No.	Part No.	Description
1	143-9-5100-36600	Drum Complete
2	143-0-771T-02400	Upper Drum Complete
3	4-226V-75350	Wiring PCB.
4		Screw, Pan Hd., Machine, 2.6x3 mm, Z1
5		Screw, Pan Hd., Machine, 2.6x6 mm, Z1
6	143-2-351T-43500	Bracket, Upper Rotary Trans.
7	143-0-260V-00400	Rotary Trans., Upper
8	143-2-776T-01250	Upper Drum
9		Screw with Spring Washer & Washer, Pan Hd., Machine, 3x6 mm, Z1
10	143-2-741T-34300	Tape Path Lever (2 used)
11	143-2-851T-56900	Spring Coil, Tape Path Lever
12	143-2-747T-05600	Bracket, Tape Path Lever
13	4-264V-14100	P.G. Coil
14		Screw with Washer, Pan Hd., Machine, 4x12 mm, Z1
15		Screw, Pan Hd., Machine, 2.6x4 mm, Z1
16	143-2-371T-00500	Bracket (2 used), Lower Rotary Trans. Fix
17	4-260V-00600	Lower Rotary Trans.
18		Screw, Pan Hd., Machine, 3x6 mm, Z1
19		Screw with Spring Washer & Washer, Pan Hd., Machine, 3x8 mm, Z1
20	143-0-242V-01700	Video Head Disk
21	143-2-772T-02600	Spacer, V-head Adj., 0.02 mm Dia
or	143-2-772T-02700	Spacer, V-head Adj., 0.04 mm Dia
or	---------------------------	Not use.
22	143-0-771T-02100	Lower Drum Complete
23		Screw with Spring & Flange Washer, Pan Hd., Machine, 3x6 mm, Z1
24	143-2-351T-44800	Bracket, Pinch Lever Guide
25	143-2-351T-44700	Bracket, REW Sensor
26		Hex. Nut, 3 mm
27		Spring Washer, 3 mm
28	4-258V-13500	REW Sensor
29	4-226V-78950	MC-3 PCB.
30	143-2-351T-44100	Cover, Pinch Roller Lever Guide
31		Screw with Spring & Flange Washer, Pan Hd., Machine, 3x8 mm, Z1
32		Screw with Spring & Flange Washer, Pan Hd., Machine, 3x16 mm, Z1
33	143-2-351T-46700	Bracket, Capstan Motor
34	4-527V-50700	Capstan Motor
37	143-0-242V-01400	Erase Head
38	143-2-851T-51000	Spring Coil (2 used), Erase Head
39	143-2-821T-07400	Tape Guide (2 used), Erase Head
40	143-2-457T-04600	Special Washer, Erase Head
41	143-2-683T-08300	Sleeve (2 used), Erase Head Roller
42	143-2-662T-00800	Roller, Erase Head
43	143-2-821T-06701	Tape Guide Shaft, Erase Head
44	143-2-421T-03400	Special Nut (2 used), Erase Head
45	143-2-421T-03200	Special Nut (2 used), Audio/Control Head
46	143-0-242V-01200	Audio/Control Head Assembly
47	143-2-851T-56800	Spring Coil (2 used), Audio/Control Head
48		Screw, Pan Hd., Machine, 3x10 mm, Z1
49	143-2-457T-06300	Special Washer (3 used)
50		"E" Ring, 2.3 mm
51	143-2-662T-09200	Guide Roller (3 used), Loading Ring
52	143-0-351T-07500	Bracket, Loading Ring Guide Roller
53	143-0-683T-00250	Loading Ring
54	143-0-545T-01700	Pinch Roller
55	143-2-851T-55600	Spring Coil, Pinch Roller
56	4-221V-11500	DEW Sensor
57		Fiber Washer, 3x8x0.5 mm
58		Set Screw, Hex. Socket Hd., Machine (Flat Point), 2.6x4 mm, CP
59	143-2-322T-20600	Shield Plate, R/P Head
60		Screw, Washer Hd., Machine (TP Screw), 3x4 mm, Z1
61	141-2-453T-30300	Washer, 3x5.4x0.13 mm
62	143-2-451T-06800	Special Washer

NOTE: Parts order must contain Model Number, Part Number and Description.

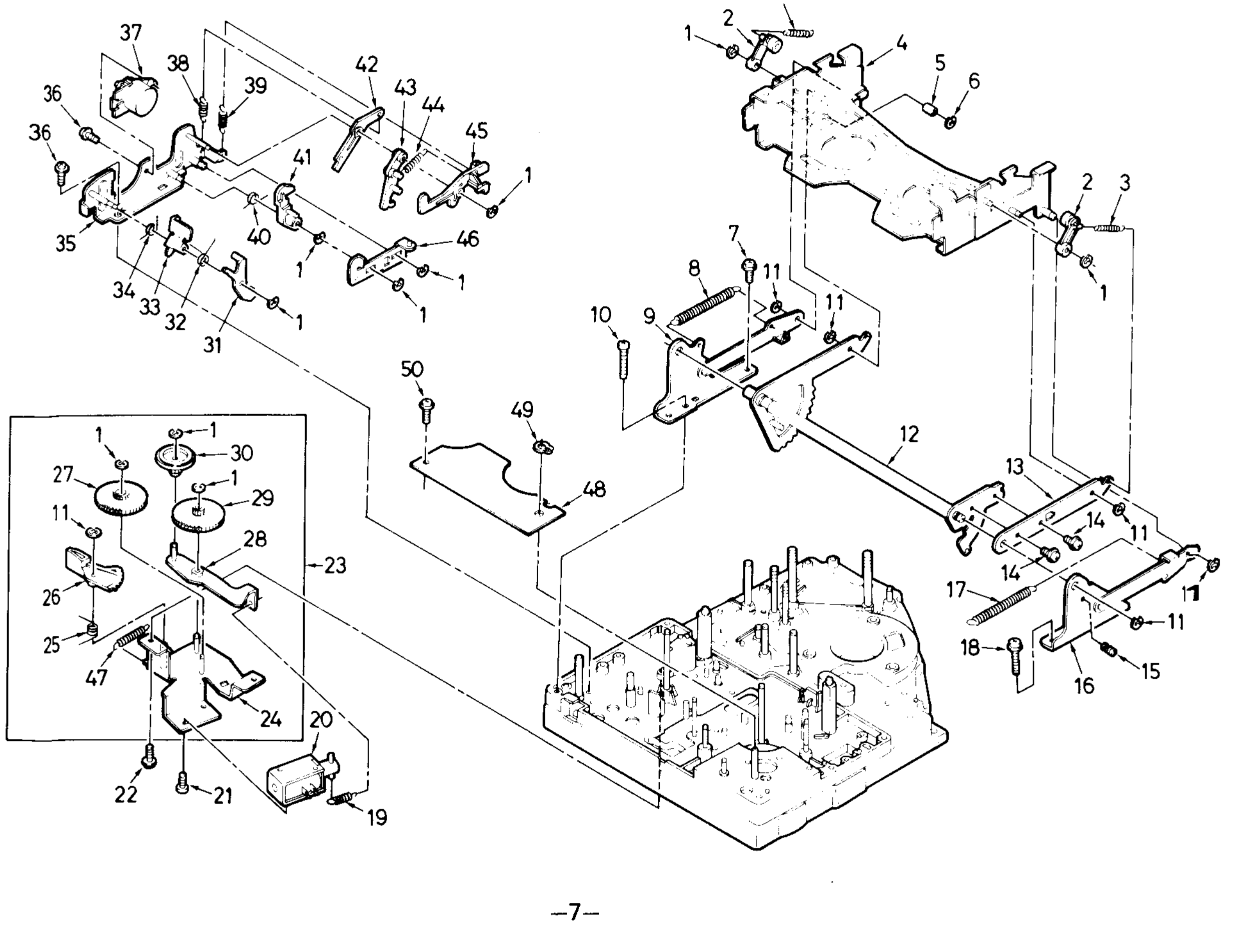


CASSETTE HOLDER MECHANISM PARTS

Ref. No.	Part No.	Description
1		"E" Ring, 2.3 mm
2	143-2-741T-32900	Lever (2 used), Cassette Hold
3	143-2-851T-55000	Spring Coil (2 used), Cassette Hold
4	143-0-351T-06900	Cassette Holder
5	143-2-662T-08900	Roller, Cassette Holder Lock
6		"E" Ring, 1.5 mm
7		Screw, Washer Hd., Tapping (B-tight), 3x10 mm, Z1
8	143-2-851T-54900	Cassette-up Spring Coil, Left Side
9	143-0-351T-07000	Cassette Holder Stand, Left Side
10		Screw, Washer Hd., Machine (TP Screw), 3x18 mm, Z1
11		"E" Ring, 3 mm
12	143-0-751T-01500	Shaft, Cassette-up
13	143-2-741T-32700	Bracket, Cassette-up
14		Screw, Washer Hd., Machine (TP Screw), 3x4 mm, Z1
15	143-2-421T-04400	Adjustment Screw, Cassette-up
16	143-0-351T-07100	Cassette Holder Stand, Right Side
17	143-2-851T-54800	Cassette-up Spring Coil, Right Side
18		Screw with Spring Washer & Washer, Pan Hd., Machine, 3x24 mm, Z1
19	143-2-851T-57600	Spring Coil, Operation "EJECT"
20	4-264V-12900	Solenoid, Operation "EJECT"
21		Screw with Spring & Flange Washer, Pan Hd., Machine, 2.6x4 mm, Z1
22		Screw, Washer Hd., Tapping (B-tight), 3x6 mm, Z1
23	143-0-581T-01800	Gear Assembly, Operation "EJECT"
24	143-0-351T-07700	Gears Base, Operation "EJECT"
25	143-2-851T-57800	Release Spring Coil, "EJECT" Drive Lever

Ref. No.	Part No.	Description
26	143-2-741T-36301	Lever, "EJECT" Drive
27	143-2-581T-04600	1 st. Gear, "EJECT" Drive
28	143-0-741T-18800	Lever, "EJECT" Drive Gears
29	143-2-581T-04500	2 nd. Gear, "EJECT" Drive
30	143-0-581T-01700	Gear, Operation "EJECT"
31	143-2-741T-35400	Lock Lever, "EJECT"
32	143-2-851T-57400	Spring Coil, "EJECT" Lock Lever
33	143-2-741T-35500	Release Lever, "EJECT" Lock Lever
34	143-2-851T-57300	Spring Coil, Return for Release Lever
35	143-0-351T-07900	Bracket, Cassette-up Damper
36		Screw, Washer Hd., Tapping (B-tight), 3x8 mm, Z1
37	143-0-774T-00501	Oil Damper
38	143-2-851T-57000	Spring Coil, Stopper Lever
39	143-2-851T-57100	Spring Coil, Cassette Actuate Lever
40	143-2-851T-56500	Spring Coil, Cassette Holder Lock Lever
41	143-2-741T-35000	Lever, Cassette Holder Lock
42	143-2-741T-34900	Stopper Lever, Cassette Holder Lock Lever
43	143-2-741T-34700	Operation Lever, Cassette Switch
44	143-2-851T-57200	Spring Coil, Operation Lever
45	143-2-741T-34800	Lever, Cassette Actuator
46	143-0-731T-01300	Release Slide, Loading Ring Stopper
47	143-2-851T-57700	Spring Coil, "EJECT" Drive
48	143-2-135T-15200	Mechanisms Cover
49		Grip Ring, 4 mm
50		Screw with Spring Washer & Washer, Pan Hd., Machine, 3x5 mm, Z1

NOTE: Parts order must contain Model Number, Part Number and Description.

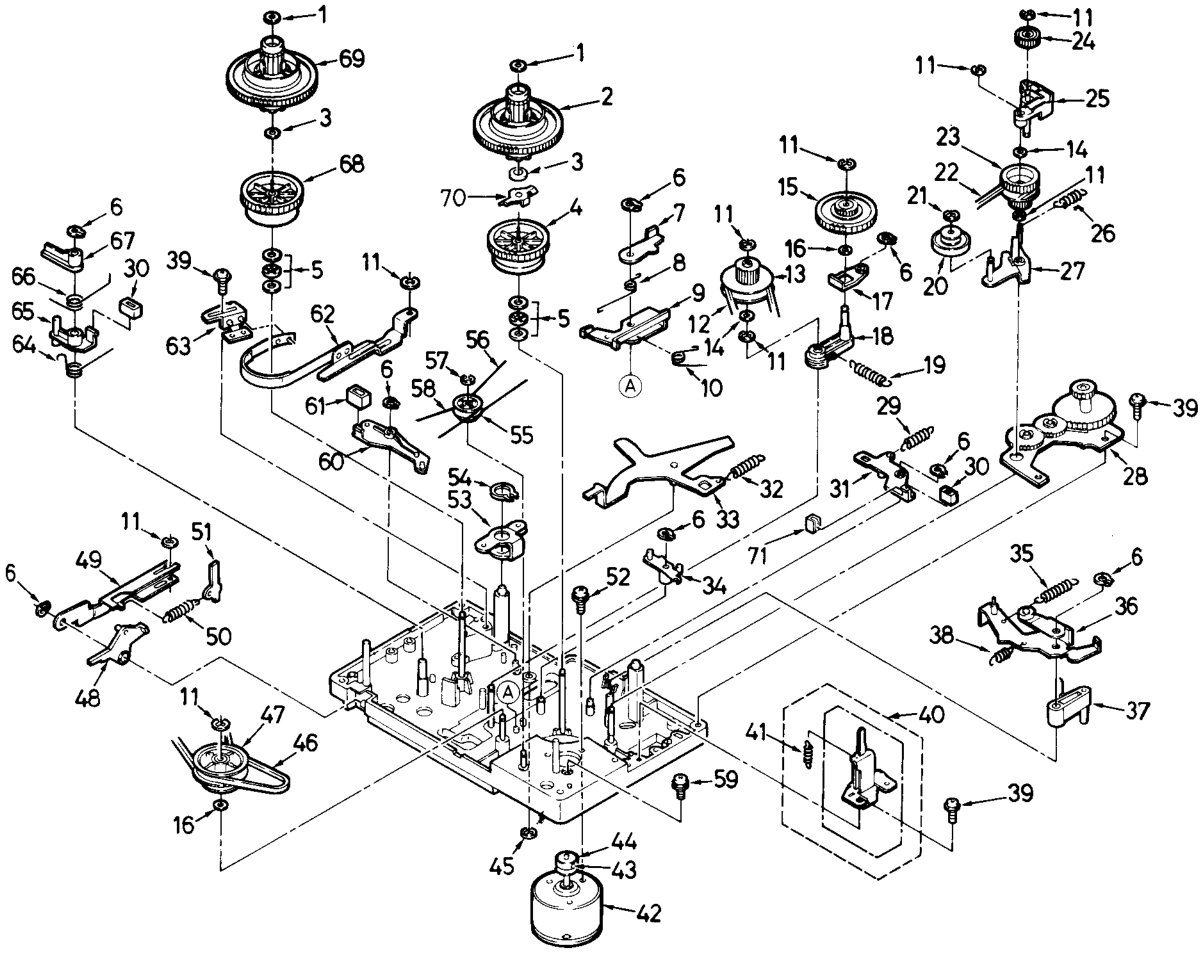


REEL DRIVE MECHANISM PARTS

Ref. No.	Part No.	Description
1	143-2-457T-05900	Stopper (2 used), Reel Bases
2	143-0-531T-02700	Take-up Reel Base
3	141-2-453T-30300	Washer, 3x5.4x0.13 mm(Reel Base Hight Adj.)
or	141-2-453T-30301	Washer, 3x5.4x0.25 mm (Reel Base Hight Adj.)
or	141-2-453T-30302	Washer, 3x5.4x0.5 mm (Reel Base Hight Adj.)
4	143-2-581T-03700	Gear, Take-up Reel Lower
5	143-2-574T-02800	Bearing (2 used), Reel Bases
6		Grip Ring, 3 mm
7	143-0-741T-19300	Back Tension Lever, R-search
8	143-2-851T-58400	Spring Coil, R-search B.T. Lever
9	143-2-741T-36700	Operation Lever, R-search B.T. Lever
10	143-2-851T-58500	Spring Coil, Operation Lever
11		"E" Ring, 2.3 mm
12	143-2-564T-02500	2 nd. Square Belt
13	143-0-581T-01600	Relay Gear, Reel Drive (Center Gear)
14	141-2-453T-30301	Washer, 3x5.4x0.5 mm
15	143-0-581T-01500	Reel Drive Gear (Idler Gear)
16	141-2-453T-30302	Washer, 3x5.4x0.5 mm
17	143-2-253T-06100	Select Link, Reel Drive Gear
18	143-2-741T-32500	Lever, Reel Drive Gear
19	143-2-851T-56000	Spring Coil, Reel Drive Gear
20	143-0-661T-03800	Loading Roller
21		"E" Ring, 2 mm
22	143-2-564T-02300	Square Belt, Loading Belt
23	143-2-581T-03800	Loading Gear "1"
24	143-2-581T-04200	Loading Gear "2"
25	143-0-741T-19100	Lever, Loading Gear "2"
26	143-2-851T-56400	Spring Coil, Loading Roller Pressure
27	143-0-741T-18900	Lever, Loading Roller
28	143-0-581T-02000	Loading Gear, Loading Ring Drive
29	143-2-851T-56200	Spring Coil, Take-up Reel Brake Pressure
30	143-2-712T-02300	Brake Shoe (2 used)
31	143-2-741T-33400	Lever, Take-up Reel Brake
32	143-2-851T-56200	Spring Coil, Brake Operation Lever
33	143-0-741T-18100	Operation Lever, Brake
34	143-2-741T-33200	Operation Lever, Loading Gear
35	143-2-851T-55800	Spring Coil, Loading End Detector Lever
36	143-0-741T-18300	Detector Lever, Loading End
37	143-2-741T-33700	Loading End Lever
38	143-2-851T-55700	Spring Coil, Gear Select
39		Screw, Washer Hd., Tapping (B-tight), 3x8 mm, Z1
40	143-0-351T-08100	Erase Prevention Detector Block
41	143-2-851T-58200	Spring Coil, Erase Prevention
42	4-529V-10800	Reel Motor
43		Set Screw, Hex. Socket Hd., Machine, (Dented point), 2.6x4 mm, CP
44	143-2-661T-68300	Reel Motor Pulley
45		"E" Ring, 3 mm
46	143-2-564T-02600	1 st. Square Belt
47	143-0-661T-03700	Relay Pulley, Reel Motor
48	143-2-741T-35800	Lever, "EJECT"
49	143-2-253T-06200	Link, "EJECT"
50	143-2-851T-55500	Spring Coil, Cassette Lock Release
51	143-2-741T-34200	Release Lever, Cassette Lock
52		Screw with Spring & Flange Washer, Pan Hd., Machine, 2.6x8 mm, Z1
53	143-0-741T-18200	Loading Ring Stopper Lever, Unloading Detect
54		Grip Ring, 8 mm
55	143-2-661T-68200	Counter Pulley

Ref. No.	Part No.	Description
56	143-2-564T-02400	Square Belt
57		"E" Ring, 1.5 mm
58	143-2-564T-02800	Square Belt, Counter Belt
59		Screw with Spring Washer & Washer, Pan Hd., Machine, 2.6x6 mm, Z1
60	143-2-741T-33300	Brake Lever, Supply Reel
61	143-2-712T-02500	Brake Shoe, Supply Reel
62	143-0-711T-00400	Brake Band, Back Tension
63	143-2-351T-43700	Bracket, Back Tension Brake Band
64	143-2-851T-55900	Spring Coil, "EJECT" Brake Lever
65	143-2-741T-33500	Lever, "EJECT" Brake
66	143-2-851T-58000	Spring Coil, Supply Soft Brake
67	143-2-741T-35200	Brake Lever, Supply Soft Brake
68	143-2-581T-03600	Gear, Supply Reel Lower
69	143-0-531T-02600	Supply Reel Base
70	143-2-853T-07200	Spring Plate
71	143-2-352T-09300	Spacer, Take-up Brake Shoe

NOTE: Parts order must contain Model Number, Part Number and Description.



A
A

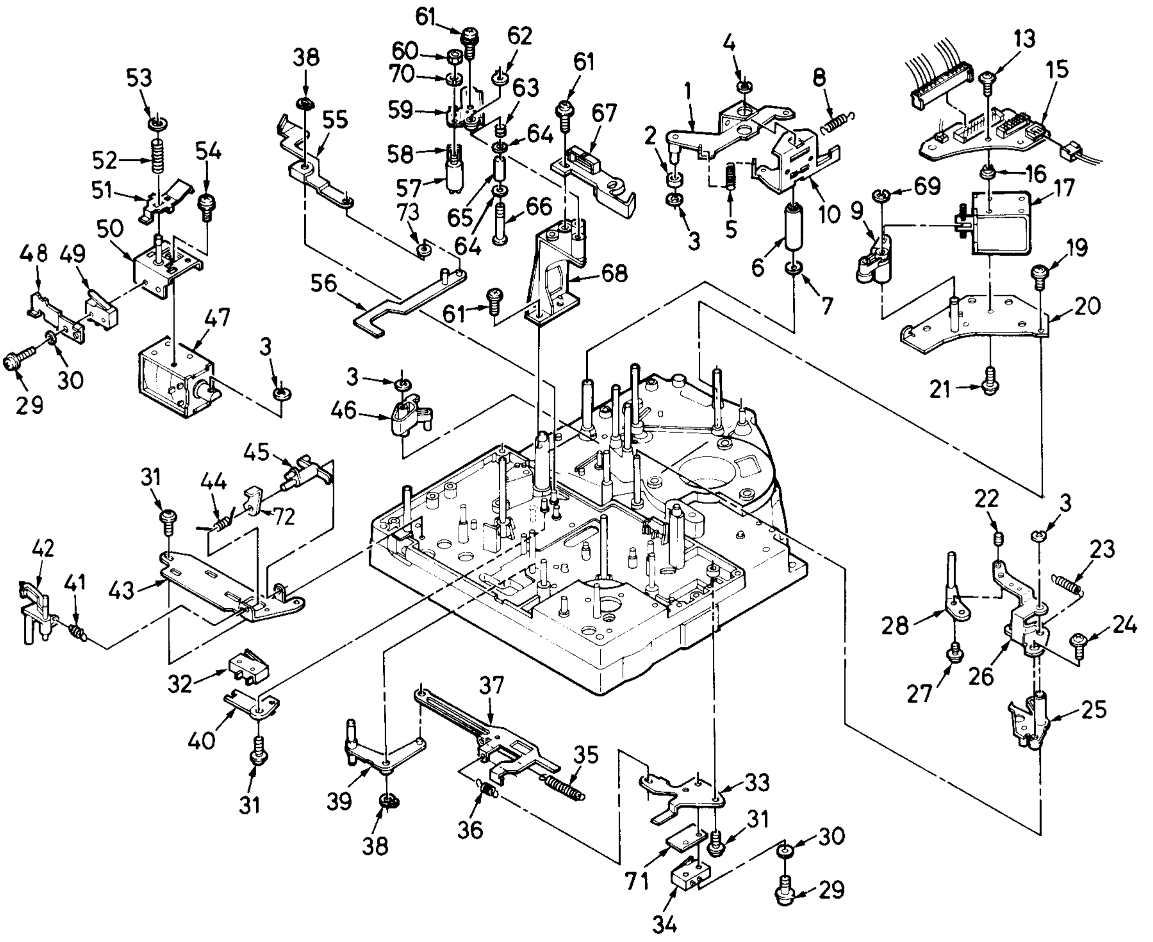
MEMO

EJECT & PINCH ROLLER PRESSURE MECHANISM PARTS

Ref. No.	Part No.	Description
1	143-0-741T-18600	Lever "2", Pinch Roller Pressure
2	143-2-662T-09100	Roller, Breake Release Lever
3		"E" Ring, 2.3 mm
4		"E" Ring, 3 mm
5	143-2-851T-56700	Spring Coil, Pinch Roller Pressure
6	143-2-462T-03200	Pipe, Pinch Roller Pressure Lever
7	141-2-453T-31701	Washer, 4x8x0.5 mm
8	143-2-851T-56600	Spring Coil, Pinch Roller Release
9	143-0-741T-18700	Operation Lever, Pinch Roller
10	143-2-741T-34400	Lever "1", Pinch Roller Pressure
13		Screw, Washer Hd., Machine (TP Screw), 3x8 mm, Z1
15	143-9-1300-00700	MC-7 Circuit Board Assembly, Wiring
16	143-2-683T-10400	Ring (2 used), PCB. Spacer
17	4-264V-13700	Solenoid, Pinch Roller Pressure
19		Screw, Washer Hd., Machine (TP Screw), 3x10 mm, Z1
20	143-0-351T-07600	Bracket, Pinch Roller Solenoid
21		Screw, Washer Hd., Machine (TP Screw), 3x4 mm, Z1
22		Set Screw, Hex. Socket Hd.(Flat point), 3x4 mm, CP
23	143-2-851T-57900	Spring Coil, Back Tension
24		Screw, Washer Hd., Tapping (B-tight), 3x6 mm, Z1
25	143-2-741T-35300	Operation Lever, Back Tension
26	143-0-741T-18500	Lever, Back Tension
27		Screw, Washer Hd., Machine (TP Screw), 3x6 mm, Z1
28	143-0-821T-00400	Tape Guide, Back Tension
29		Screw with Spring Washer, Pan Hd., Machine, 2.3x12 mm, Z1
30		Bolt Washer, 2.6x6x0.5 mm
31		Screw, Washer Hd., Tapping (B-tight), 3x6 mm, Z1
32	4-231V-99400	Cassette-in Switch
or	4-231V-80301	Cassette-in Switch
or	4-231V-99600	Cassette-in Switch
33	143-2-351T-44300	Bracket, Switches
34	4-231V-80400	Loading End Switch
or	4-231V-80401	Loading End Switch
or	4-231V-99400	Loading End Switch
35	143-2-851T-55300	Spring Coil, EJECT Slide Release
36	143-2-851T-55400	Spring Coil, EJECT Slide
37	143-2-731T-08700	EJECT Slide
38		Grip Ring, 3 mm
39	143-0-741T-18400	Joint Lever, EJECT
40	143-2-351T-44200	Bracket, Cassette Switch
41	143-2-851T-56300	Spring Coil, F FWD/REW Solenoid Lever
42	143-0-741T-18000	Lever, F FWD/REW Solenoid
43	143-2-351T-45600	Bracket, F FWD/REW Solenoid
44	143-2-851T-57500	Spring Coil, Gear Select Lever
45	143-0-741T-17900	Select Lever, Reel Drive Lever
46	143-2-741T-35100	Operation Lever, Back Tension Lever
47	4-264V-13800	F FWD/REW Solenoid
48	143-2-351T-47100	Wiring Bracket
49	4-231V-80301	EJECT "2" Switch
or	4-231V-80400	EJECT "2" Switch
or	4-231V-99600	EJECT "2" Switch
50	143-0-351T-08000	Bracket, EJECT "2" Switch
51	143-2-741T-36500	Operation Lever, EJECT "2" Switch
52	143-2-851T-58300	Spring Coil, EJECT "2" Switch
53		Speed Nut, 2.4 mm, CP

Ref. No.	Part No.	Description
54		Screw with Spring Washer & Washer, Pan Hd., Machine, 3x4 mm, Z1
55	143-2-741T-33800	Lever, Release Breake
56	143-0-731T-01200	Lever, PLAY Release Breake
57	4-258V-13400	FWD Sensor
58	4-226V-78850	MC-2 PCB.
59	143-0-822T-01200	Bracket, FWD Sensor
60		Hex. Nut, 3 mm
61		Screw with Spring & Flange Washer, Pan Hd., Machine, 3x8 mm, Z1
62	143-2-411T-01600	Special Nut, FWD Sensor Tape Guide
63	143-2-851T-58100	Spring Coil, FWD Sensor Tape Guide
64	143-2-457T-06100	Special Washer (2 used), FWD Sensor Tape Guide
65	143-2-821T-08000	Tape Guide, FWD Sensor
66	143-2-751T-50100	Shaft, FWD Sensor Tape Guide
67	143-2-135T-14600	Wiring Cover
68	143-2-351T-46300	Bracket, FWD Sensor
69		"E" Ring, 4 mm
70		Spring Washer, 3 mm
71	143-2-352T-08300	Switch Spacer
72	143-2-465T-09700	Stopper
73	141-2-453T-30302	Washer, 3x5.4x0.5 mm

NOTE: Parts order must contain Model Number, Part Number and Description.



MEMO

ELECTRICAL PARTS

NOTE:

* Materials of Capacitors are abbreviated as follows;

Elect.,	Electrolytic Capacitor
NP. Elect.,	Non-Polarized Electrolytic
Mylar	Mylar Film Capacitor
Polypro	Polypropylene Capacitor
M. Polypro	Metallized Polypropylene Capacitor
TF	Thin Film Capacitor

* Tolerance of Capacitor are noted with follow symboles;

A	+50−10%	M	±20%
G	±2%	N	±30%
J	±5%	P	+100−0%
K	±10%	Z	+80−20%

* All resistors are of carbon type, ±5%, 1/4 watt unless otherwise noted.

(1) VD-1 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
		***VIDEO "1" CIRCUIT**
		... Location No. 1001~
RY1001	4-232V-14600	Relay, MZ12S
DL1001	4-284V-13400	Delay Line, 1H
DL1002	4-284V-13600	Delay Line, 270ns
DL1003	4-284V-13600	Delay Line, 270ns
		(VARIABLE RESISTORS)
VR1001	4-222V-61705	1K ohms
VR1002	4-222V-61705	1K ohms
VR1003	4-222V-61706	2K ohms
VR1004	4-222V-61709	20K ohms
VR1005	4-222V-61707	5K ohms
VR1006	4-222V-61707	5K ohms
VR1007	4-222V-61707	5K ohms
VR1008	4-222V-61709	20K ohms
VR1009	4-222V-61709	20K ohms
VR1010	4-222V-61705	1K ohms
VR1011	4-222V-61704	500 ohms
		(COILS)
L1001	4-253V-85825	HF Choke, 100μH
L1002	4-253V-85825	HF Choke, 100μH
L1003	4-253V-85826	HF Choke, 120μH
L1004	4-253V-85828	HF Choke, 180μH
L1005	4-253V-85826	HF Choke, 120μH
L1006	4-253V-85823	HF Choke, 68μH
L1007	4-253V-85823	HF Choke, 68μH
L1008	4-253V-85816	HF Choke, 18μH
L1009	4-253V-85827	HF Choke, 150μH
L1010	4-253V-85817	HF Choke, 22μH
L1011	4-253V-85822	HF Choke, 56μH
L1012	4-253V-94500	HF Choke, 5.6mH
L1013	4-253V-85821	HF Choke, 47μH
L1014	4-253V-85827	HF Choke, 150μH
L1015	4-253V-85816	HF Choke, 18μH
L1016	4-253V-85816	HF Choke, 18μH
L1017	4-253V-85816	HF Choke, 18μH
L1019	4-253V-85817	HF Choke, 22μH
L1020	4-253V-85828	HF Choke, 180μH
L1021	4-253V-85829	HF Choke, 220μH
L1022	4-253V-85828	HF Choke, 180μH
L1023	4-253V-85827	HF Choke, 150μH
		(COIL TRANSFORMERS)
T1001	4-259V-21100	HF Coil Trans.
T1002	4-259V-20200	HF Coil Trans.
T1003	4-259V-20300	HF Coil Trans.

Schematic Location	Parts No.	Description
		(IC's & TRANSISTORS)
Q1001		IC, HA11703
Q1002		IC, TC4069P
Q1003		IC, HA11701
Q1004		IC, LA7013
Q1005		2SA844D or 2SA838B or C
Q1006		2SC930E or D
Q1007		2SC1741Q or R
Q1008		2SC1741Q or R
Q1009		2SC930E or D
Q1010		2SC930E or D
Q1011		2SC930E or D
Q1012		2SC930E or D
Q1013		2SA844D or 2SA838B or C
Q1014		2SC930E or D
Q1015		2SC930E or D
Q1016		2SC945Q or R or 2SC536E or F
Q1017		2SA844D or 2SA838B or C
Q1018		2SC945Q or R or 2SC536E or F
Q1019		2SC930E or D
Q1020		2SC945Q or R or 2SC536E or F
Q1021		2SC945Q or R or 2SC536E or F
Q1022		2SC945Q or R or 2SC536E or F
Q1023		2SC930E or D
Q1024		2SA844D or 2SA838B or C
Q1025		2SA844D or 2SA838B or C
Q1026		2SC930E or D
Q1027		2SC930E or D
Q1028		2SC930E or D
Q1033		2SC930E or D
Q1034		2SA844D or 2SA838B or C
Q1035		2SC930E or D
Q1036		2SC930E or D
Q1037		2SC930E or D
Q1039		2SB544D or E
Q1040		2SC945Q or R or 2SC536E or F
Q1041		2SC945Q or R or 2SC536E or F
		(DIODES)
D1001		1S1555
D1002		1S1555
D1003		1S2473 or 1SS133
D1004		1S2473 or 1SS133
D1005		1S1555
D1006		1S1555
D1011		1S2473 or 1SS133
D1013		1S2473 or 1SS133

Schematic Location	Parts No.	Description
		(CAPACITORS)
C1001		Elect., 33mfd (M), 16V
C1002		Ceramic, 180pF (J), 50V
C1003		Ceramic, 100pF (J), 50V
C1004		Ceramic, 82pF,(J), 50V
C1005		Elect., 10mfd (M), 16V
C1006		BL Ceramic, 0.01mfd (K), 25V
C1009		Elect., 10mfd (M), 16V
C1110		Elect., 1000mfd (M), 10V
C1011		Ceramic, 13pF (J), 50V
C1012		Ceramic, 51pF (J), 50V
C1013		Ceramic, 51pF (J), 50V
C1014		Ceramic, 13pF (J), 50V
C1015		BL Ceramic, 0.01mfd (K), 25V
C1016		Ceramic, 18pF (J), 50V
C1017		Ceramic, 47pF (J), 50V, CH
C1018		Ceramic, 18pF (J), 50V
C1019		BL Ceramic, 0.047mfd (K), 25V
C1020		Elect., 47mfd (M), 16V
C1021		BL Ceramic, 0.01mfd (K), 25V
C1022		Ceramic, 680pF (J), 50V
C1023		Ceramic, 220pF (J), 50V
C1024		Ceramic, 16pF (J), 50V
C1026		BL Ceramic 0.01mfd (K), 25V
C1027		Elect., 47mfd (M), 16V
C1028		Elect., 100mfd (M), 10V
C1029		Ceramic, 47pF (J), 50V
C1030		Elect., 47mfd (M), 16V
C1031		BL Ceramic, 0.047mfd (K), 25V
C1032		Ceramic, 18pF (J), 50V
C1033		Ceramic, 390pF (J), 50V
C1034		Ceramic, 180pF (J), 50V
C1035		Ceramic, 300pF (J), 50V
C1036		Ceramic, 510pF (J), 50V
C1037		Ceramic, 510pF (J), 50V
C1038		Mylar, 0.0056mfd (J), 50V
C1039		Ceramic, 3300pF (J), 50V
C1040		BL Ceramic, 0.022mfd (K), 25V
C1041		Elect., 47mfd (M), 16V
C1042		BL Ceramic, 0.047mfd (K), 25V
C1043		Aluminium, 0.68mfd (K), 50V
C1044		Ceramic, 150pF (J), 50V
C1044		Ceramic, 15pF (J), 50V
C1046		Ceramic, 75pF (J), 50V
C1047		Elect., 47mfd (M), 10V
C1048		Mylar, 0.1mfd (M), 50V
C1049		Ceramic, 75pF (J), 50V
C1050		Ceramic, 33pF (J), 50V
C1051		Elect., 47mfd (M), 16V
C1052		Elect., 33mfd (M), 16V
C1053		Elect., 1mfd (M), 50V
C1054		Ceramic, 56pF (J), 50V
C1055		Ceramic, 82pF (J), 50V
C1056		Elect., 47mfd (M), 16V
C1057		BL Ceramic, 0.047mfd (K), 25V
C1058		Ceramic, 430pF (J), 50V
C1059		Ceramic, 390pF (J), 50V
C1060		BL Ceramic, 0.01mfd (K), 25V
C1063		BL Ceramic, 0.01mfd (K), 25V
C1064		BL Ceramic, 0.01mfd (K), 25V
C1065		BL Ceramic, 0.01mfd (K), 25V
C1067		Ceramic, 120pF (J), 50V
C1074		Ceramic, 120pF (J), 50V
C1075		Elect., 220mfd (M), 6.3V
C1076		Ceramic, 180pF (J), 50V

Schematic Location	Parts No.	Description
C1077		Ceramic, 6pF (J), 50V
C1078		Ceramic, 16pF (J), 50V
C1079		Ceramic, 16pF (J), 50V
C1080		Ceramic, 6pF (J), 50V
C1081		Elect., 100mfd (M), 10V
C1082		Elect., 100mfd (M), 10V
C1083		Elect., 47mfd (M), 16V
C1084		BL Ceramic 0.01mfd (K), 25V
C1085		BL Ceramic 0.047mfd (K), 25V
C1086		Elect., 47mfd (M), 16V
C1087		Ceramic, 51pF (J), 50V, CH
C1088		Ceramic 27pF (J), 50V
C1089		BL Ceramic, 0.047mfd (K), 25V
C1090		Ceramic, 2700pF (J), 50V
C1091		Elect., 10mfd (M), 16V
C1092		Ceramic, 820pF (J), 50V
C1093		Elect., 100mfd (M), 10V
C1094		Ceramic, 120pF (J), 50V
C1095		Ceramic, 100pF (J), 50V
C1096		Elect., 22mfd (M), 16V
C1097		Ceramic, 330pF (J), 50V
C1100		Ceramic, 0.047mfd (K), 25V
C1101		Ceramic, 0.047mfd (K), 25V
C1102		Ceramic, 0.047mfd (K), 25V
C1104		Ceramic, 0.047mfd (K), 25V
		(RESISTORS)
R1001		1K ohms
R1002		1K ohms
R1003		2.4K ohms
R1005		3.3K ohms
R1007		2.2K ohms
R1008		33K ohms
R1009		390K ohms
R1010		750 ohms
R1011		68 ohms
R1012		150 ohms
R1013		150 ohms
R1014		3.9K ohms
R1015		1K ohms
R1016		1.8K ohms
R1017		10K ohms
R1018		1.8K ohms
R1019		10K ohms
R1020		56K ohms
R1021		1K ohms
R1022		470 ohms
R1023		1K ohms
R1024		100 ohms
R1025		2.2K ohms
R1026		22K ohms
R1027		22K ohms
R1028		3.3K ohms
R1029		1K ohms
R1030		1K ohms
R1031		4.7K ohms
R1032		1K ohms
R1033		750 ohms
R1034		330K ohms
R1035		560 ohms
R1036		1K ohms
R1037		240 ohms
R1038		22K ohms
R1039		1.5K ohms
R1040		820 ohms

Schematic Location	Parts No.	Description
R1041		1.5K ohms
R1042		1.5K ohms
R1043		1K ohms
R1044		10K ohms
R1045		1K ohms
R1046		160 ohms
R1047		330 ohms
R1048		22K ohms
R1049		22K ohms
R1050		2.2K ohms
R1051		390 ohms
R1052		820 ohms
R1053		240 ohms
R1054		270 ohms
R1055		1.8K ohms
R1056		1.6K ohms
R1057		1.2K ohms
R1058		18K ohms
R1059		8.2K ohms
R1060		7.5K ohms
R1061		7.5K ohms
R1062		3.9K ohms
R1063		62K ohms
R1064		1K ohms
R1065		1K ohms
R1066		6.8K ohms
R1067		5.1K ohms
R1068		2K ohms
R1069		1K ohms
R1070		820 ohms
R1071		3.3K ohms
R1072		1.2K ohms
R1073		680 ohms
R1074		200K ohms
R1075		10K ohms
R1076		56K ohms
R1077		56K ohms
R1078		68K ohms
R1079		8.2K ohms
R1080		5.6K ohms
R1081		75 ohms
R1082		33K ohms
R1083		33K ohms
R1084		10K ohms
R1085		1K ohms
R1086		160 ohms
R1087		330 ohms
R1088		22K ohms
R1089		390 ohms
R1090		22K ohms
R1091		2.2K ohms
R1092		910 ohms
R1093		820 ohms
R1094		430 ohms
R1095		1.2K ohms
R1096		2K ohms
R1097		1.8K ohms
R1098		18K ohms
R1099		18K ohms
R1100		2.7K ohms
R1101		24 ohms
R1102		150 ohms
R1103		270 ohms
R1104		1.6K ohms
R1105		1.8K ohms

Schematic Location	Parts No.	Description
R1106		1K ohms
R1107		4.7K ohms
R1108		820 ohms
R1109		3.9K ohms
R1110		33K ohms
R1111		33K ohms
R1112		270 ohms
R1113		270 ohms
R1114		560 ohms
R1115		470 ohms
R1116		33K ohms
R1117		33K ohms
R1118		100 ohms
R1119		82 ohms
R1121		1.5K ohms
R1122		750 ohms
R1134		3.3K ohms
R1135		620 ohms
R1136		560 ohms
R1137		560 ohms
R1138		3.9K ohms
R1139		12K ohms
R1140		1K ohms
R1141		1K ohms
R1142		3.3K ohms
R1143		3.3K ohms
R1144		3.3K ohms
R1145		3.3K ohms
R1146		3.3K ohms
R1147		3.3K ohms
R1148		100 ohms
R1149		470 ohms
R1150		680 ohms
R1151		47 ohms
R1152		13K ohms
R1153		1K ohms
R1154		9.1K ohms
R1155		56K ohms
R1156		22K ohms
R1157		22K ohms
R1158		3.6K ohms
R1159		33K ohms
R1160		10K ohms
R1161		33K ohms
R1162		1K ohms
R1170		56K ohms
R1171		6.8K ohms
		***VIDEO PRE-AMP CIRCUIT . . . Location No. 1501 ~**
	143-2-322T-21300	Shield Plate, Pattern Side
	143-2-322T-13900	Shield Plate, Parts Side
		(VARIABLE RESISTORS)
VR1501	4-222V-61707	5K ohms
VR1502	4-222V-61706	2K ohms
VR1503	4-222V-61706	2K ohms
VR1504	4-222V-61705	1K ohms
VR1505	4-222V-61715	3K ohms
VR1506	4-222V-61706	2K ohms
		(COILS)
L1501	4-253V-89255	HF Choke, 0.56μH
L1502	4-253V-89257	HF Choke, 0.82μH
L1503	4-253V-85245	HF Choke, 1mH

Schematic Location	Parts No.	Description
L1504	4-253V-85826	HF Choke, 120μH
L1505	4-253V-88317	HF Choke, 2.2mH
L1506	4-253V-85245	HF Choke, 1mH
L1508	4-253V-88323	HF Choke, 6.8mH
L1509	4-253V-88323	HF Choke, 6.8mH
L1510	4-253V-85815	HF Choke, 15μH
L1511	4-253V-85815	HF Choke, 15μH
L1512	4-253V-85813	HF Choke, 10μH
		(IC's & TRANSISTORS)
Q1501		IC, CX-134A
Q1502		FET, 2SK152-2 or 3
Q1503		FET, 2SK152-2 or 3
Q1504		2SC536E or F
Q1505		2SC536E or F
Q1506		2SC536E or F
Q1507		2SC930E or F
Q1508		2SA838B or C or 2SA844D
Q1509		2SA564Q or 2SA838B or C
Q1510		2SC1815Y
Q1511		2SC930E or F
Q1512		2SC536E or F
Q1513		2SC930E or F
		(DIODES)
D1501		1S1555 or 1S2473
D1502		1S1555 or 1S2473
D1503		1S1555 or 1S2473
D1504		1S1555 or 1S2473
D1507		1S1555 or 1S2473
D1509		1S1555 or 1S2473
D1510		1S1555 or 1S2473
		(CAPACITORS)
C1501		BL Ceramic, 0.022mfd (M), 25V
C1502		BL Ceramic, 0.022mfd (M), 25V
C1503		BL Ceramic, 0.047mfd (M), 25V
C1504		BL Ceramic, 0.01mfd (K), 25V
C1505		BL Ceramic, 0.022mfd (M), 25V
C1506		BL Ceramic, 0.022mfd (M), 25V
C1507		BL Ceramic, 0.022mfd (M), 25V
C1508		BL Ceramic, 0.047mfd (M), 25V
C1509		BL Ceramic, 0.01mfd (K), 25V
C1510		Tantalum, 10mfd (M), 16V
C1511		BL Ceramic, 0.022mfd (M), 25V
C1512		BL Ceramic, 0.022mfd (M), 25V
C1513		Ceramic, 330pF (J), 50V
C1514		Elect., 10mfd (M), 16V
C1515		BL Ceramic, 0.01mfd (K), 25V
C1516		Ceramic, 470pF (J), 50V
C1517		Ceramic, 470pF (J), 50V
C1518		Ceramic, 51pF (J), 50V
C1519		BL Ceramic, 2700pF (K), 25V
C1520		BL Ceramic, 4700pF (K), 25V
C1524		Ceramic, 51pF (J), 50V
C1525		Ceramic, 68pF (J), 50V
C1526		BL Ceramic, 4700pF (K), 50V
C1527		BL Ceramic, 4700pF (K), 50V
C1528		Elect., 10mfd (M), 16V
C1529		Elect., 10mfd (M), 16V
C1531		BL Ceramic, 0.01mfd (K), 25V
C1532		Ceramic, 100pF (J), 50V
C1533		BL Ceramic, 0.01mfd (K), 25V
C1534		BL Ceramic 0.022mfd (M), 25V
C1535		Elect., 47mfd (M), 16V

Schematic Location	Parts No.	Description
C1536		Elect., 0.47mfd (M), 25V
C1537		Ceramic, 36pF (J), 50V
C1538		Ceramic, 18pF (J), 50V
C1539		Elect., 33mfd (M), 16V
C1540		Elect., 33 mfd (M), 16V
C1541		Ceramic, 33pF (J), 50V
		(RESISTORS)
R1501		3.3K ohms
R1502		390 ohms
R1503		10K ohms
R1504		620 ohms
R1505		390 ohms
R1506		10K ohms
R1507		3.3K ohms
R1508		390 ohms
R1509		620 ohms
R1510		390 ohms
R1511		10K ohms
R1512		5.6K ohms
R1513		100 ohms
R1514		620 ohms
R1515		1K ohms
R1516		5.6K ohms
R1517		4.7K ohms
R1518		2.2K ohms
R1519		390 ohms
R1520		33K ohms
R1521		Non Flammable, 8.2 ohms
R1522		15K ohms
R1524		1.2K ohms
R1525		560 ohms
R1526		1K ohms
R1527		1K ohms
R1528		1K ohms
R1529		1K ohms
R1530		2.2K ohms
R1531		2.2K ohms
R1532		10K ohms
R1534		Non Flammable, 8.2 ohms
R1535		220 ohms
R1538		6.8 ohms
R1539		430 ohms
R1542		Non Flammable, 8.2 ohms
R1543		16K ohms
R1544		3.3K ohms
R1545		56K ohms
R1546		10K ohms
R1547		1K ohms
R1548		680 ohms
R1549		390 ohms
R1550		82K ohms
R1551		10K ohms
R1552		430 ohms
R1553		7.5 ohms
R1554		1.5K ohms
R1555		1.5K ohms
R1556		Non Flammable, 82 ohms
R1557		Non Flammable, 39 ohms
R1558		100 ohms
R1559		100 ohms
R1560		470 ohms
R1561		120 ohms
R1563		5.6K ohms
R1564		5.6K ohms

Schematic Location	Parts No.	Description
		***AUDIO CIRCUIT ... Location No. 2001 ~**
T2001	4-258V-14100	Coil Transformer
		(VARIABLE RESISTORS)
VR2001	4-222V-64407	20K ohms
VR2002	4-222V-64406	10K ohms
VR2003	4-222V-61713	500K ohms
VR2004	4-222V-64406	10K ohms
		(COILS)
L2001	4-253V-95600	HF Choke, 27mH
L2002	4-253V-90101	HF Choke, 7mH
L2003	4-253V-95800	HF Choke, 27mH
L2004	4-253V-84110	HF Choke, 560μH
		(IC's & TRANSISTORS)
Q2001		IC, BA5102
Q2002		2SD1011S or T
Q2003		2SD1011S or T
Q2004		2SC945P or Q
Q2005		2SA1016F or G
Q2008		2SC536E or F
Q2009		2SC536E or F
Q2011		2SC536E or F
Q2012		2SD438E or F
		(DIODES)
D2001		1SS133
D2002		1SS133
D2003		1SS133
D2004		1SS133
		(CAPACITORS)
C2001		Elect., 2.2mfd (M), 16V
C2002		Elect., 47mfd (M), 6.3V
C2003		Elect., 22mfd (M), 6.3V
C2004		Elect., 100mfd (M), 16V
C2005		Elect., 22mfd (M), 16V
C2006		Elect., 4.7mfd (M), 16V
C2007		Elect., 4.7mfd (M), 16V
C2008		Elect., 0.47mfd (M), 16V
C2009		BL Ceramic, 0.033mfd (K), 25V
C2012		Mylar, 0.15mfd (K), 50V
C2013		Elect., 4.7mfd (M), 16V
C2015		Ceramic, 200pF (K), 50V
C2016		Elect., 2.2mfd (M), 16V
C2017		Elect., 10mfd (M), 16V
C2018		Ceramic, 0.012mfd (K), 50V
C2019		Ceramic, 330pF (K), 50V
C2021		Elect., 3.3mfd (M), 16V
C2022		Elect., 0.47mfd (M), 16V
C2023		Elect., 100mfd (M), 16V
C2024		Ceramic, 4700pF (K), 50V
C2025		Ceramic, 220pF (K), 50V
C2026		Elect., 47mfd (M), 6.3V
C2027		Ceramic, 1200pF (K), 50V
C2028		Ceramic, 0.01mfd (M), 25V
C2029		Ceramic, 220pF (K), 50V
C2031		Polypropylene, 0.022mfd (K), 200V
C2032		Aluminium, 4.7mfd (M), 25V
C2033		Mylar, 0.033mfd (K), 50V
C2034		Mylar, 0.01mfd (K), 50V
C2035		Mylar, 0.01mfd (K), 50V
C2036		Elect., 47mfd (M), 16V
		(RESISTORS)
R2001		47K ohms
R2002		390 ohms
R2003		2.2K ohms
R2004		18K ohms
R2005		33K ohms
R2006		2.2K ohms
R2007		47K ohms
R2008		1K ohms
R2009		6.8K ohms
R2011		8.2K ohms
R2012		3.3K ohms
R2015		3.3K ohms
R2016		2.2K ohms
R2017		2.2K ohms
R2018		120K ohms
R2019		180 ohms
R2023		2.2K ohms
R2024		390 ohms
R2025		4.7K ohms
R2026		15K ohms
R2027		2.2K ohms
R2028		10K ohms
R2029		10K ohms
R2030		10K ohms
R2031		10K ohms
R2032		10K ohms
R2033		3.3K ohms
R2034		10K ohms
R2035		22K ohms
R2036		10K ohms
R2037		10K ohms
R2038	4-221V-11400	Non Flammable, 10 ohms
R2044		5.6K ohms
R2047		2.2K ohms
R2048		5.6K ohms
R2049		10K ohms
R2051		100K ohms
R2052		100K ohms
R2053		4.7K ohms
R2054		5.6K ohms

(2) VD-2 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
		***VIDEO "2" CIRCUIT . . . Location No.1201 ~**
BPF1201	4-228V-15000	LC Pack
PL1201	4-284V-13300	2H Delay Line
X1201	4-225V-18400	Crystal
or	4-225V-19000	Crystal
X1202	4-225V-18800	Crystal
or	4-225V-18900	Crystal
		(VARIABLE RESISTORS)
VR1201	4-222V-61704	500 ohms
VR1203	4-222V-61705	1K ohms
VR1204	4-222V-61709	20K ohms
VR1205	4-222V-61708	10K ohms
VR1206	4-222V-61707	5K ohms
VR1207	4-222V-61713	500K ohms
VR1208	4-222V-61705	1K ohms
VR1209	4-222V-61705	1K ohms
	COILS)	**(COILS)**
L1201	4-253V-85821	HF Choke, 47μH
L1203	4-253V-85814	HF Choke, 12μH
L1204	4-253V-85823	HF Choke, 68μH
L1205	4-253V-85823	HF Choke, 68μH
L1206	4-253V-85826	HF Choke, 120μH
L1207	4-253V-85826	HF Choke, 120μH
L1208	4-253V-85824	HF Choke, 82μH
L1209	4-253V-85812	HF Choke, 8.2μH
L1210	4-253V-85817	HF Choke, 22μH
L1211	4-253V-85823	HF Choke, 68μH
L1212	4-253V-85833	HF Choke, 470μH
L1214	4-253V-94200	HF Choke, 6.8mH
L1215	4-253V-85833	HF Choke, 470μH
L1216	4-253V-85821	HF Choke, 47μH
L1217	4-253V-85825	HF Choke, 100μH
L1218	4-253V-93300	HF Choke, 1mH
		(COIL TRANSFORMER)
T1201	4-259V-20400	HF Coil Trans.
T1202	4-259V-20500	HF Coil Trans.
T1203	4-259V-20600	HF Coil Trans.
T1204	4-259V-20700	HF Coil Trans.
T1205	4-259V-15700	HF Coil Trans.
T1206	4-259V-15800	HF Coil Trans.
T1207	4-259V-20800	HF Coil Trans.
T1208	4-259V-20900	HF Coil Trans.
T1209	4-259V-21000	HF Coil Trans.
T1210	4-253V-92800	HF Choke Coil, 4.7mH
or	4-253V-94900	HF Choke Coil, 4.7mH
		(IC's & TRANSISTORS)
Q1201		IC, CX832
Q1202		IC, TC4053BP
Q1203		IC, CX136A
Q1204		IC, CX150A
Q1205		IC, MB14300A
Q1206		IC, M58478P
Q1207		2SC930E or D
Q1208		2SC930E or D
Q1209		2SC930E or D
Q1210		2SC930E or D
Q1211		2SC930E or D
Q1212		2SC930E or D
Q1213		2SC930E or D
Q1214		2SC930E or D
Q1215		2SC536E or F or 2SC945Q or R
Q1216		2SC930E or D
Q1217		2SC930E or D
Q1218		2SC930E or D
Q1219		2SC536E or F or 2SC945Q or R
Q1220		2SC536E or F or 2SC945Q or R
Q1221		2SC536E or F or 2SC945Q or R
Q1222		2SC930E or D
Q1223		2SC536E or F or 2SC945Q or R
Q1224		2SC930E or D
Q1225		2SC930E or D
Q1226		2SC536E or F or 2SC945Q or R
Q1227		2SA608E or F or 2SA844D
Q1228		2SA608E or F or 2SA844D
Q1229		2SA608E or F or 2SA844D
Q1230		2SA608E or F or 2SA844D
Q1232		2SD400D or E
Q1233		2SC536E or F or 2SC945Q or R
Q1234		2SC930E or D
Q1235		2SC536E or F or 2SC945Q or R
Q1236		2SC536E or F or 2SC945Q or R
Q1237		2SC930E or D
Q1238		2SA564AR or AQ
Q1239		2SC536E or F or 2SC945Q or R
Q1240		2SC536E or F or 2SC945Q or R
Q1241		2SC536E or F or 2SC945Q or R
		(DIODES)
D1201		1S2473 or 1SS133
D1202		1S2473 or 1SS133
D1203		1S2473 or 1SS133
D1204		1S2473 or 1SS133
D1205		1S2473 or 1SS133
D1206		1S2473 or 1SS133
D1207		1S2473 or 1SS133
D1208		1S2473 or 1SS133
D1209		1S2473 or 1SS133
D1210		1S2473 or 1SS133
D1211		1S2473 or 1SS133
D1212		1S2473 or 1SS133
D1213		1S2473 or 1SS133
D1214		1S2473 or 1SS133
D1215		1S2473 or 1SS133
D1216		1S2473 or 1SS133
D1217		1S2473 or 1SS133
D1218		Zener, RD6.2EB or GZA6.2Y
D1219		Zener, RD5.6EB1 or GZA5.6Y
D1220		1S2473 or 1SS133

Schematic Location	Parts No.	Description
		(CAPACITORS)
C1201		BL Ceramic, 0.01mfd (K), 25V
C1202		BL Ceramic, 0.01mfd (K), 25V
C1203		Ceramic, 5pF (J), 50V
C1205		BL Ceramic, 0.047mfd (K), 25V
C1206		BL Ceramic, 0.01mfd (K), 25V
C1207		BL Ceramic, 0.01mfd (K), 25V
C1208		BL Ceramic, 0.047mfd (K), 25V
C1209		Elect., 47mfd (M), 16V
C1210		BL Ceramic, 0.01mfd (K), 25V
C1212		BL Ceramic, 0.01mfd (K), 25V
C1213		BL Ceramic, 0.022mfd (K), 25V
C1214		Tantalum, 2.2mfd (J), 16V
C1215		BL Ceramic, 0.01mfd (K), 25V
C1216		Elect., 47mfd (M), 16V
C1217		Elect., 1mfd (M), 50V
C1218		Elect., 47mfd (M), 10V
C1219		Ceramic, 100pF (J), 50V
C1220		BL Ceramic, 0.047mfd (K), 25V
C1221		Ceramic, 330pF (J), 50V
C1222		Ceramic, 100pF (J), 50V
C1223		BL Ceramic, 0.01mfd (K), 25V
C1224		BL Ceramic, 0.047mfd (K), 25V
C1225		BL Ceramic, 0.01mfd (K), 25V
C1226		BL Ceramic, 0.047mfd (K), 25V
C1227		Elect., 47mfd (M), 16V
C1228		Elect., 10mfd (M), 16V
C1229		BL Ceramic, 0.01mfd (K), 25V
C1230		Ceramic, 240pF (J), 50V
C1231		Ceramic, 56pF (J), 50V
C1232		Ceramic, 390pF (J), 50V
C1233		BL Ceramic, 0.01mfd (K), 25V
C1234		Ceramic, 18pF (J), 50V
C1235		BL Ceramic, 0.047mfd (K), 25V
C1236		BL Ceramic, 0.047mfd (K), 25V
C1237		BL Ceramic, 0.047mfd (K), 25V
C1238		Elect., 4.7mfd (M), 25V
C1239		Elect., 4.7mfd (M), 25V
C1240		BL Ceramic, 0.01mfd (K), 25V
C1241		BL Ceramic, 0.01mfd (K), 25V
C1242		Ceramic, 220pF (J), 50V
C1243		Ceramic, 27pF (J), 50V
C1244		Ceramic, 27pF (J), 50V
C1245		Ceramic, 56pF (J), 50V
C1246		Ceramic, 470pF (J), 50V
C1247		BL Ceramic, 0.047mfd (K), 25V
C1248		Tantalum, 1.5mfd (J), 16V
C1249		Elect., 10mfd (M), 16V
C1251		BL Ceramic, 0.01mfd (K), 25V
C1252		Ceramic, 47pF (J), 50V, CH
C1253		BL Ceramic, 0.01mfd (K),25V
C1255		BL Ceramic, 0.047mfd (K), 25V
C1256		Elect., 1mfd (M), 50V
C1257		Mylar, 0.012mfd (M), 50V
C1258		Elect., 1mfd (M), 50V
C1259		Ceramic, 15pF (J), 50V, CH
C1260		Mylar, 0.012mfd (M), 50V
C1261		BL Ceramic, 0.01mfd (K), 25V
C1264		BL Ceramic, 0.01mfd (K), 25V
C1265		Ceramic, 120pF (J), 50V
C1266		Ceramic, 4700pF (J), 50V
C1267		Ceramic, 220pF (J), 50V
C1268		Elect., 1mfd (M), 50V
C1269		BL Ceramic, 0.01mfd (K), 25V
C1270		Ceramic, 27pF (J), 50V CH

Schematic Location	Parts No.	Description
C1271		Elect., 1mfd (M), 50V
C1272		Ceramic, 1000pF (J), 50V
C1273		Ceramic, 4700pF (J), 50V
C1274		Ceramic, 330pF (J), 50V
C1275		Mylar, 0.01mfd (M), 50V
C1278		Ceramic, 30pF (J), 50V
C1279		Ceramic, 1000pF (J), 50V
C1280		Ceramic, 1000pF (J), 50V
C1281		BL Ceramic, 0.01mfd (K), 25V
C1282		BL Ceramic, 0.01mfd (K), 25V
C1283		BL Ceramic, 0.01mfd (K), 25V
C1284		BL Ceramic, 0.01mfd (K), 25V
C1285		Elect., 1mfd (M), 50V
C1286		Ceramic, 2200pF (J), 50V
C1287		Ceramic, 120pF (J), 50V
C1288		BL Ceramic, 0.01mfd (K), 25V
C1289		BL Ceramic, 0.01mfd (K), 25V
C1290		BL Ceramic, 0.01mfd (K), 25V
C1291		BL Ceramic, 0.01mfd (K), 25V
C1292		BL Ceramic, 0.01mfd (K), 25V
C1293		BL Ceramic, 0.01mfd (K), 25V
C1294		Ceramic, 150pF (J), 50V
C1295		Ceramic, 150pF (J), 50V
C1297		BL Ceramic, 0.01mfd (K), 25V
C1298		BL Ceramic, 0.01mfd (K), 25V
C1300		BL Ceramic, 0.022mfd (K), 25V
C1301		Elect., 47mfd (M), 16V
C1302		BL Ceramic, 0.047mfd (K), 25V
C1303		Elect., 4.7mfd (M), 25V
C1304		Mylar, 0.0082mfd (M), 50V
C1305		Mylar, 0.022mfd (M), 50V
C1306		Ceramic, 330pF (J), 50V
C1307		BL Ceramic, 0.01mfd (K), 25V
C1308		Ceramic, 330pF (J), 50V
C1309		Elect., 0.047mfd (M), 50V
C1310		BL Ceramic, 0.047mfd (K), 25V
C1311		BL Ceramic, 0.022mfd (K), 25V
C1312		Elect., 10mfd (M), 16V
C1313		BL Ceramic, 0.047mfd (K), 25V
C1314		Elect., 47mfd (M), 16V
C1315		BL Ceramic, 0.047mfd (K), 25V
C1316		BL Ceramic, 0.047mfd (K), 25V
C1318		BL Ceramic, 0.047mfd (K), 25V
		(RESISTORS)
R1201		750 ohms
R1202		330 ohms
R1203		56K ohms
R1204		10K ohms
R1205		47K ohms
R1206		2.2K ohms
R1207		390 ohms
R1208		390 ohms
R1209		390 ohms
R1210		390 ohms
R1211		390 ohms
R1212		2.2K ohms
R1213		390 ohms
R1214		22K ohms
R1215		4.7K ohms
R1216		220K ohms
R1217		1K ohms
R1218		4.7K ohms
R1219		220K ohms
R1220		56K ohms

Schematic Location	Parts No.	Description
R1221		5.6K ohms
R1222		1K ohms
R1223		2.2K ohms
R1224		270 ohms
R1225		4.7K ohms
R1226		750 ohms
R1227		10K ohms
R1228		1.8K ohms
R1229		5.6K ohms
R1230		510 ohms
R1231		1K ohms
R1232		680 ohms
R1233		18K ohms
R1234		30K ohms
R1235		100 ohms
R1236		4.7K ohms
R1237		1K ohms
R1238		1K ohms
R1239		1K ohms
R1240		2.2K ohms
R1241		220K ohms
R1242		1.2K ohms
R1243		1K ohms
R1245		100K ohms
R1246		220K ohms
R1247		4.7K ohms
R1248		22K ohms
R1249		33K ohms
R1250		22K ohms
R1251		22K ohms
R1252		33K ohms
R1253		220 ohms
R1254		33K ohms
R1255		5.6K ohms
R1256		27K ohms
R1257		2.2K ohms
R1258		5.6K ohms
R1259		6.8K ohms
R1260		1K ohms
R1261		680 ohms
R1262		56K ohms
R1263		10K ohms
R1264		3.3K ohms
R1265		8.2K ohms
R1266		10K ohms
R1267		56K ohms
R1268		1K ohms
R1269		820 ohms
R1270		1.5K ohms
R1271		470 ohms
R1272		1K ohms
R1273		33K ohms
R1274		10K ohms
R1275		4.7K ohms
R1276		100 ohms
R1277		6.8K ohms
R1278		7.5K ohms
R1279		220K ohms
R1280		330 ohms
R1281		3K ohms
R1282		1.8K ohms
R1283		5.1K ohms
R1284		10K ohms
R1285		39K ohms
R1286		5.6K ohms

Schematic Location	Parts No.	Description
R1287		24K ohms
R1288		33K ohms
R1289		3.3K ohms
R1292		15K ohms
R1293		15K ohms
R1294		6.8K ohms
R1295		15K ohms
R1296		2.7K ohms
R1297		5.1K ohms
R1298		10K ohms
R1299		100K ohms
R1300		120K ohms
R1301		56K ohms
R1302		27K ohms
R1303		56K ohms
R1304		33K ohms
R1305		750 ohms
R1306		220 ohms
R1307		2.2K ohms
R1308		39 ohms
R1309		56K ohms
R1310		10K ohms
R1311		12K ohms
R1312		10K ohms
R1313		10K ohms
R1314		20K ohms
R1315		56K ohms
R1316		56K ohms
R1317		56K ohms
R1318		33K ohms
R1319		33K ohms
R1320		33K ohms
R1321		330 ohms
R1322		33K ohms
R1323		33K ohms
R1324		470 ohms
R1325		1.2K ohms
R1326		4.7K ohms
R1327		1.5K ohms
R1328		1K ohms
R1329		1K ohms
R1330		1.5K ohms
R1331		1K ohms
R1332		4.7K ohms
R1333		3K ohms
R1334		33K ohms
R1335		15K ohms
R1336		10K ohms
R1337		10K ohms
R1338		15K ohms
R1339		7.5K ohms
R1340		1K ohms
R1341		10K ohms
R1342		3K ohms
R1343		1K ohms
R1344		1K ohms
R1345		1.5K ohms
R1346		4.7M ohms
R1347		2.2K ohms
R1348		5.6K ohms
R1349		100K ohms
R1350		47K ohms
R1351		390 ohms
R1352		33K ohms
R1353		33K ohms

Schematic Location	Parts No.	Description
R1354		1K ohms
R1355		5.6K ohms
R1356		10K ohms
R1357		10K ohms
		***SYSTEM CONTROL CIRCUIT . . . Location No.3001~**
CF3001	4-953V-03400	Ceramic Oscillator, CSB400P
	143-2-368T-05400	Heat Sink (Q3019)
	143-0-236V-49800	Connector with Leads, 4 pin
		(IC's & TRANSISTORS)
Q3001		IC, LM6402
Q3002		IC, LC7800
Q3003		IC, LC7800
Q3004		IC, TC4028B or MC14028B
Q3005		IC, LA7011
Q3006		IC, BA6135
Q3007		IC, LC4011B or TC4011B or MC14011B
Q3008		IC, TC4069B or MC14069B
Q3009		IC, LB1274K
Q3010		IC, LB1274K
Q3013		2SD439E or F
Q3014		2SC536E or F
Q3015		2SC536E or F
Q3017		2SA937Q or R
Q3018		2SA937Q or R
Q3019		2SD325E or F
Q3020		2SB632E or F
Q3021		2SB632E or F
Q3022		2SD894
Q3023		2SD894
Q3024		2SD894
Q3025		2SD894 or 2SD947
Q3026		2SD894
Q3027		2SD894 or 2SD947
Q3028		2SD894 or 2SD947
		(DIODES)
D3002		Zener, GZA5.6U
D3003		DS135D
D3004		DS135D
D3005		DS135D
D3006		DS135D
D3007		DS135D
D3008		DS442
D3009		DS442
D3010		DS442
D3011		DS442
D3018		DS442
D3019		DS442
D3020		DS442
D3021		DS442
D3022		DS442
D3023		DS442
D3024		DS442
D3025		DS442
D3026		DS442
D3027		DS442
D3028		DS442
D3029		DS442

Schematic Location	Parts No.	Description
		(CAPACITORS)
C3001		Elect., 100mfd (M), 16V
C3002		Elect., 47mfd (M), 16V
C3003		BL Ceramic, 0.1mfd (K), 25V
C3004		BL Ceramic, 0.1mfd (K), 25V
C3005		BL Ceramic, 0.1mfd (K), 25V
C3008		Elect., 10mfd (M), 16V
C3009		Elect., 0.1mfd (M), 16V
C3010		Elect., 10mfd (M), 16V
C3011		Elect., 2.2mfd (M), 16V
C3012		Elect., 4.7mfd (M), 16V
C3013		Ceramic, 330pF (J), 50V
C3014		Ceramic, 470pF (J), 50V
C3015		Elect., 10mfd (K), 25V
C3016		Elect., 10mfd (M), 25V
C3017		Elect., 47mfd (M), 6.3V
C3020		BL Ceramic, 0.01mfd (K), 25V
		(RESISTORS)
R3001	4-957V-10313	R-pack, 10K ohms x 13
R3002	4-957V-10308	R-pack, 10K ohms x 8
R3003	4-957V-47208	R-pack, 4.7K ohms x 8
R3004	4-957V-47213	R-pack, 4.7K ohms x 13
R3010		1K ohms
R3011		240K ohms
R3012		220K ohms
R3013		18K ohms
R3014		620 ohms
R3015		4.7M ohms
R3016		330K ohms
R3017		270K ohms
R3018		100K ohms
R3019		100K ohms
R3020		1K ohms
R3021		1K ohms
R3022		1K ohms
R3023		1K ohms
R3024		1K ohms
R3025		1K ohms
R3026		1K ohms
R3027		1K ohms
R3028		1K ohms
R3029		1K ohms
R3030		1K ohms
R3031		1K ohms
R3032		1K ohms
R3033		1K ohms
R3034		1K ohms
R3035		22K ohms
R3036		2.2K ohms
R3037		1M ohms
R3038		4.7K ohms
R3039		10K ohms
R3042		2.2K ohms
R3043		2.2K ohms
R3044		2.2K ohms
R3045		2.2K ohms
R3046		2.2K ohms
R3047		10K ohms
R3048		10K ohms
R3049		10K ohms
R3050		10K ohms
R3051		330 ohms
R3052		270 ohms
R3053		Non Flammable, 1 ohms

Schematic Location	Parts No.	Description
R3054		470 ohms
R3055		100K ohms
R3056		100K ohms
R3057		470 ohms
R3058		22K ohms
R3059		22K ohms
R3060		22K ohms
R3061		22K ohms
R3062		10K ohms
R3063		33K ohms
R3064		33K ohms
R3065		33K ohms
R3066		33K ohms
R3067		33K ohms
R3068		33K ohms
R3069		33K ohms
R3070		33K ohms
R3075		10K ohms
R3076		12K ohms
R3077		33K ohms
R3078		2.2K ohms
R3079		1K ohms
R3080		100K ohms
R3081		100K ohms
R3089		10K ohms

(3) SY-2 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
	143-2-374T-01200	Panel, Control LED's
SW3401	4-231V-64600	PLAY Switch
SW3402	4-231V-64600	STOP Switch
SW3403	4-231V-64600	REW Switch
SW3404	4-231V-64600	F. FWD Switch
SW3405	4-231V-64600	PAUSE Switch
SW3406	4-231V-64600	EJECT Switch
SW3407	4-231V-64600	REC Switch
SW3408	4-231V-64700	REC LOCK Switch
		(DIODES)
D3401		LED, AR2432B ... DEW light
D3402		LED, AR2432B ... REC light
D3403		LED, AR2432B ... REW light
D3404		LED, AR2432B ... PLAY light
D3405		LED, AR2432B ... F. FWD light
D3406		LED, AR-2432B ... PAUSE light
		(RESISTORS)
R3401		470 ohms
R3402		470 ohms
R3403		470 ohms
R3404		470 ohms
R3405		470 ohms
R3406		470 ohms

(4) MC-1 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
Q3501		Transistor, 2SC536E or F
C3501		Elect. Capacitor (Super Small), 33mfd, 16V
C3502		Elect. Capacitor (Super Small), 10mfd, 16V
		(RESISTORS)
R3501		330K ohms
R3502		100K ohms
R3503		1K ohms
R3504		10K ohms
R3505		100 ohms
R3506	4-221V-10700	Magnetic Sensor DM101A

(5) SV-1 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
		(VARIABLE RESISTORS)
VR4001	4-222V-62818	68K ohms
VR4002	4-222V-62818	68K ohms
VR4003	4-222V-62817	47K ohms
VR4004	4-222V-63118	Metal Glaze, 100K ohms
VR4005	4-222V-62818	68K ohms
VR4006	4-222V-63117	Metal Glaze, 47K ohms
		(IC's & TRANSISTORS)
Q4001		IC, CX-186
Q4003		2SA933Q or R
Q4004		2SD400F or 2SD863F
Q4005		IC, CX-143A
Q4006		2SC536F, or 2SC1815GR or 2SC2603F
Q4007		2SA933Q or R
Q4008		2SA933Q or R
Q4009		IC, TC4016B or CD4066B or MB84066B
Q4010		2SA933Q or R
Q4011		2SA933Q or R
Q4012		IC, TA7340P
Q4013		IC, BA222
Q4014		2SC1634-7
Q4015		2SD1010R or S
Q4016		2SC536F or 2SC1815GR or 2SC2603F
Q4017		IC, NJM2904D
Q4018		2SC536F or 2SC1815GR or 2SC2603F
Q4019		2SC536F or 2SC1815GR or 2SC2603F
		(DIODES)
D4001		1S1555 or DS442 or 1SS133
D4002		1S1555 or DS442 or 1SS133
D4003		1S1555 or DS442 or 1SS133
D4004		1S1555 or DS442 or 1SS133
D4005		Zener, XZ100
D4006		1S1555 or DS442 or 1SS133
D4007		1S1555 or DS442 or 1SS133
D4008		Zener, GZA12X

Schematic Location	Parts No.	Description
		(CAPACITORS)
C4001		Mylar, 0.068mfd (J), 50V
C4002		Elect., 10mfd (M), 16V
C4003		Mylar, 0.018mfd (J), 50V
C4004		Mylar, 0.018mfd (J), 50V
C4005		Tantalum, 0.22mfd (K), 35V
C4006		Mylar, 1000pF (J), 50V
C4007		Mylar, 0.047mfd (J), 50V
C4008		NP. Elect., 2.2mfd (M), 25V
C4009		Tantalum, 0.33mfd (K), 35V
C4010		Mylar, 0.033mfd (J), 50V
C4011		Aluminium, 0.22mfd (M), 16V
or		Tantalum, 0.22mfd (K), 35V
C4012		Elect., 2.2mfd (M), 50V
C4013		Mylar, 1000pF (J), 50V
C4014		Mylar, 0.1mfd (J), 50V
C4015		Mylar, 0.047mfd (J), 50V
C4016		Mylar, 0.082mfd (J), 50V
C4017		Polypropylene, 0.1mfd (J), 100V
C4018		Mylar, 0.033mfd (J), 50V
C4019		Elect., 33mfd (M), 16V
C4020		Elect., 220mfd (M), 16V
C4021		Polypropylene, 0.082mfd (J), 100V
C4022		Mylar, 4700pF (J), 50V
C4023		Mylar, 0.1mfd (J), 50V
C4024		Aluminium, 0.47mfd (M), 16V
or		Tantalum, 0.47mfd (K), 35V
C4025		Mylar, 0.047mfd (J), 50V
C4026		Elect., 47mfd (M), 16V
C4027		NP Elect., 2.2mfd (M), 25V
C4028		Elect., 1mfd (M), 50V
C4029		Tantalum, 0.47mfd (K), 35V
C4030		Tantalum, 0.47mfd (K), 35V
C4031		Tantalum, 0.47mfd (K), 35V
C4032		Ceramic, 1000pF (J), 50V
C4033		Mylar, 0.047mfd (J), 50V
C4034		NP Elect., 2.2mfd (M), 25V
C4035		Mylar, 0.047mfd (J), 50V
C4036		Tantalum, 0.47mfd (K), 35V
C4037		Ceramic, 1000pF (J), 50V
C4038		NP Elect., 1mfd (M), 25V
C4039		Elect., 1mfd (M), 50V
C4040		Elect., 1mfd (M), 50V
C4041		Elect., 4.7mfd (M), 25V
C4042		Tantalum, 0.33mfd (K), 35V
C4043		Elect., 33mfd (M), 16V
C4044		Elect., 22mfd (M), 16V
C4045		Elect., 47mfd (M), 16V
C4046		Elect., 1mfd (M), 50V
C4047		NP Elect., 1mfd (M), 25V
C4048		Elect., 330mfd (M), 16V
C4049		Elect., 47mfd (M), 16V
C4050		Elect., 220mfd (M), 16V
C4051		Mylar, 0.022mfd (J), 50V
C4052		Mylar, 0.033mfd (J), 50V
C4053		Elect., 100mfd (M), 16V
		(RESISTORS)
R4001		33K ohms
R4002		33K ohms
R4003		33K ohms
R4004		5.6K ohms
R4005		33K ohms
R4006		6.8K ohms
R4007		6.8K ohms
R4008		390K ohms
R4009		4.7M ohms
R4010		56K ohms
R4011		1.8K ohms
R4012		10K ohms
R4013		22K ohms
R4014		18K ohms
R4015		39K ohms
R4016		6.8K ohms
R4017		6.8K ohms
R4018		33K ohms
R4019		10K ohms
R4020		120K ohms
R4021		33K ohms
R4022		470 ohms
R4023		Metal Glaze, 27K ohms, ±2%
R4024		33K ohms
R4028		10K ohms
R4029		47K ohms
R4030		47K ohms
R4031		220 ohms
R4032		Metal Glaze, 270K ohms, ±2%
R4033		33K ohms
R4034		47K ohms
R4035		120K ohms
R4036		560 ohms
R4037		4.7K ohms
R4038		8.2K ohms
R4039		47K ohms
R4040		180K ohms
R4041		1K ohms
R4042		56K ohms
R4043		1K ohms
R4044		18K ohms
R4045		2.2K ohms
R4046		1K ohms
R4047		100K ohms
R4048		100K ohms
R4049		10K ohms
R4050		33K ohms
R4051		1K ohms
R4052		1K ohms
R4053		47K ohms
R4054		47K ohms
R4055		5.1M ohms
R4056		390K ohms
R4057		10K ohms
R4058		10K ohms
R4059		33K ohms
R4060		10K ohms
R4061		2.2K ohms
R4062		18K ohms
R4064		5.6K ohms
R4065		10K ohms
R4066		1K ohms
R4067		1K ohms
R4069		4.7K ohms
R4070		10K ohms
R4071		10K ohms
R4072		47K ohms
R4073		5.6K ohms
R4074		1.2K ohms
R4075		22K ohms
R4076		10K ohms

Schematic Location	Parts No.	Description
R4077		180 ohms
R4078		12K ohms
R4079		82K ohms
R4080		47K ohms
R4081		27K ohms
R4082		10K ohms
R4083		1K ohms
R4084		4.7K ohms
R4085		1K ohms
R4086		1.8K ohms
R4087		22K ohms
R4088		10K ohms
R4089		5.6K ohms
R4090		39K ohms
R4091		3.3K ohms
R4092		4.7K ohms
R4093		330 ohms
R4094		1K ohms
R4095		5.6K ohms
R4096		6.8K ohms
R4097		6.8K ohms
R4098		1.5K ohms
R4099		470K ohms
R4100		10K ohms
R4101		100K ohms
R4102		10K ohms
R4103		10K ohms
R4104		100K ohms
R4105		100K ohms
R4106		1K ohms
R4107		10K ohms
R4108		10K ohms
R4109		47K ohms
R4110		33K ohms
R4111		10K ohms
R4112		56K ohms
R4113		4.7K ohms
R4114		2.2K ohms
R4115		1K ohms
R4116		1K ohms
R4117		1K ohms

(6) SV-2 PCB. ELECTRICAL PARTS .... Capstan Motor

Schematic Location	Parts No.	Description
		(IC's & TRANSISTORS)
Q4301		Magnetic Sensor, H200A
Q4302		Magnetic Sensor, H200A
Q4303		Magnetic Sensor, H200A
Q4304		IC, PD102
Q4305		2SA1115E or F or 2SA608E or F or 2SA733P or Q or 2SA1048Y or GR
Q4306		2SA1115E or F or 2SA608E or F or 2SA733P or Q or 2SA1048Y or GR
Q4307		2SA1115E or F or 2SA608E or F or 2SA733P or Q or 2SA1048Y or GR

Schematic Location	Parts No.	Description
Q4308		2SA1115E or F or 2SA608E or F or 2SA733P or Q or 2SA1048Y or GR
Q4309		2SC536E or F or G or 2SC2603E or F or G or 2SC945K or P or Q or 2SC458C or D or 2SC2458Y or GR
		(DIODE)
D4301		Zener, RD5.1EL1 or HZ5C2
		(CAPACITORS)
C4301		BL Ceramic, 0.01mfd (M), 16V
C4302		BL Ceramic, 0.047mfd (M), 16V
C4303		BL Ceramic, 0.047mfd (M), 16V
C4304		Elect., 10mfd (M), 25V
C4305		Elect., 10mfd (M), 25V
C4306		Elect., 10mfd (M), 25V
C4307		Elect., 22mfd (M), 16V
		(RESISTORS)
R4301		Non Flammable, 2.2 ohms
R4302		220K ohms
R4303		33K ohms
R4304		47K ohms
R4305		47K ohms
R4306		47K ohms
R4307		47K ohms
R4308		2.7K ohms
R4309		4.7K ohms
R4310		10K ohms
R4311		2.2K ohms
R4312		1.2K ohms
R4313		100K ohms
R4314		10K ohms
R4315		3.9K ohms

(7) PW-1 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
	143-2-368F-04800	Heat Sink, Transistors & Diode
	143-2-322T-19100	Shield Plate, Cover
	143-2-322T-19300	Shield Frame, Parts Side
	143-2-322T-19200	Shield Plate, Pattern Side
T5001	⚠ 4-234V-15418	Fuse, 1.6A
or	⚠ 4-234V-12509	Fuse, 1.6A
	143-2-383T-03100	Fuse Holder (2 used)
		(VARIABLE RESISTORS)
VR5001	4-222V-62504	1K ohms
or	4-222V-62502	1K ohms
VR5002	4-222V-62605	2K ohms
or	4-222V-62500	2K ohms
VR5003	4-222V-62504	1K ohms
or	4-222V-62502	1K ohms

Schematic Location	Parts No.	Description
		(COILS)
L5001	4-253V-93400	HF Choke, 200μH,
L5002	4-253V-95300	HF Choke, 1.5mH,
L5003	4-253V-88622	HF Choke, 5.6μH,
L5004	4-253V-95400	HF Choke, 10μH,
L5005	4-471V-10200	Core
		(IC's & TRANSISTORS)
Q5001		IC, TL494CN
Q5002		IC, TL494CN
Q5003		2SB828R or S
Q5004		2SB825Q or R or S
Q5005		2SC19830
Q5006		2SC536E or F or G
Q5007		2SA608E or F or G
Q5008		2SC536E or F or G
Q5009		2SC536E or F or G
Q5010		2SB698D or E or F
Q5011		2SC536E or F or G
Q5013		2SD863D or E or F
		(DIODES)
D5001		DBA60B or C or S5 VB10 or RB601
D5002		DS135D or C
D5003		S5KC20R or CTU22R
D5004		BZ150
D5005		BZ 182
D5006		XZ062 or GZA6.2Y
D5007		XZ127 or GZA13X
D5008		1S2473
D5009		XZ084 or GZA8.2Z
D5010		1S2473 or 1S1555
		(CAPACITORS)
C5001		Elect., 2200mfd (M), 35V
C5002		Elect., 47mfd (M), 100V
C5003		Ceramic, 0.01mfd (K), 50V
C5004		Ceramic, 0.01mfd (K), 50V
C5005		Ceramic, 0.01mfd (K), 50V
C5006		Ceramic, 0.01mfd (K), 50V
C5007		Elect., 470mfd (M), 16V
C5008		Elect., 100mfd (M), 16V
C5009		Elect., 47mfd (M), 35V
C5010		Elect., 2.2mfd (M), 50V
C5011		Elect., 47mfd (M), 16V
C5012		Elect., 100mfd (M), 25V
C5013		Mylar, 0.001mfd (K), 50V
C5014		Elect., 330mfd (M), 25V
C5016		Elect., 3.3mfd (M), 50V
C5017		Ceramic, 0.01mfd (K), 50V
		(RESISTORS)
R5001		Metal Glaze, 1K ohms, 1W
R5002		Fusible, 33 ohms
R5003		47 ohms
R5004		Metal Glaze, 270 ohms, 1W
R5005		100K ohms
R5006		6.8K ohms
R5007		560 ohms
R5008		15K ohms
R5009		Metal Glaze, 0.22 ohms, 1/2W
R5010		Metal Glaze, 0.22 ohms, 1/2W
R5011		8.2K ohms

Schematic Location	Parts No.	Description
R5012		1.8K ohms
R5013		4.7K ohms
R5014		4.7K ohms
R5015		10K ohms
R5016		47K ohms
R5017		33K ohms
R5018		100K ohms
R5019		270 ohms
R5020		8.2K ohms
R5021		1.5K ohms
R5022		1K ohms
R5023		2.2K ohms
R5024		47 ohms
R5025		1K ohms
R5026		100K ohms
R5027		47K ohms
R5028		820 ohms
R5029		82K ohms
R5030		Metal Glaze, 0.22 ohms, 1/2W
R5031		12K ohms
R5032		1.8K ohms
R5033		4.7K ohms
R5034		4.7K ohms
R5036		1.5K ohms
R5037		12K ohms
R5038		470 ohms
R5040		10 ohms

(8) PW-2 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
F5201	⚠ 4-243V-15414	Fuse, 630mA
	143-2-383T-03100	Fuse Holder (2 used)
	143-2-135T-16300	Fuse Cover
L5201	⚠ 4-252V-11600	LF Choke Coil
or	⚠ 4-252V-11800	LF Choke Coil
C5201	⚠ 4-223V-18900	Elect., Capacitor, 0.1 mfd, 250V
or	⚠ 4-223V-20200	Elect., Capacitor, 0.1 mfd, 250V

(9) TN-1 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
		(VARIABLE RESISTORS)
VR6001	4-222V-65812	1M ohms
VR6002	4-222V-65805	5K ohms
VR6003	4-222V-65806	10K ohms
		(FILTERS)
F6001	4-953V-04000	Filter
F6002	4-953V-00100	Filter
F6003	4-953V-00300	Filter
F6004	4-953V-04100	Filter

Schematic Location	Parts No.	Description
		(COIL TRANSFORMERS & COILS)
T6001	4-256V-24700	IF Trans.
T6002	4-256V-24800	IF Trans.
L6001	4-253V-94700	HF Choke, 0.68μH
L6002	4-253V-94800	HF Choke, 0.83μH
L6003	4-253V-95100	HF Choke, 1.3μH
L6005	4-253V-85914	HF Choke, 12μH
L6006	4-253V-85912	HF Choke, 8.2μH
L6007	4-253V-85915	HF Choke, 15μH
L6008	4-253V-85912	HF Choke, 8.2μH
		(IC's & TRANSISTORS)
Q6001		2SC2216
Q6002		2SC536E or F
Q6003		2SC536E or F
Q6004		2SD545E or F
Q6005		IC, TA7607AP
Q6006		IC, LA1365
		(CAPACITORS)
C6001		Ceramic, 0.01mfd (P), 50V
C6002		Ceramic, 0.01mfd (P), 50V
C6003		Elect., 47mfd (M), 25V
C6005		Elect., 0.47mfd (M), 25V
C6006		Ceramic, 0.01mfd (P), 50V
C6008		Ceramic, 0.01mfd (P), 50V
C6009		Ceramic, 1000pF (K), 50V
C6010		Ceramic, 2pF (±0.5pF), 50V, CH
C6011		Ceramic, 56pF (J), 50V, RH
C6012		Ceramic, 82pF (J), 50V, CH
C6013		Ceramic, 2pF (±0.5pF), 50V, CH
C6014		Ceramic, 12pF (J), 50V, CH
C6015		Ceramic, 0.01mfd (P), 50V
C6016		Elect., 2.2mfd (M), 25V
C6017		Ceramic, 1000pF (K), 50V
C6018		Ceramic, 0.01mfd (P), 50V
C6019		Elect., 1mfd (M), 25V
C6020		Ceramic, 47pF (J), 50V
C6021		Ceramic, 47pF (J), 50V
C6022		Elect., 2.2mfd (M), 25V
C6023		Ceramic, 0.01mfd (P), 50V
C6024		Elect., 100mfd (M), 25V
C6025		Mylar, 6800pF (K), 50V
C6026		Ceramic, 68pF (J), 50V, RH
C6027		Elect., 4.7mfd (M), 25V
C6028		Ceramic, 4pF (±0.25pF), 50V, CH
C6029		Elect., 470mfd (M), 10V
C6030		Ceramic, 0.01mfd (P), 50V
		(RESISTORS)
R6001		180 ohms
R6002		5.6K ohms
R6004		390 ohms
R6005		1K ohms
R6006		33 ohms
R6007		820K ohms
R6008		820 ohms
R6009		5.6K ohms
R6010		1K ohms
R6011		1K ohms
R6012		220 ohms
R6013		1K ohms
R6014		1K ohms
R6015		100K ohms
R6016		150K ohms

Schematic Location	Parts No.	Description
R6017		2.7K ohms
R6018		1K ohms
R6019		270 ohms
R6020		2.2K ohms
R6021		1K ohms
R6022		150 ohms
R6024		100 ohms
R6025		560 ohms
R6026		Non Flammable, 33 ohms
R6027		680 ohms
R6028		1K ohms
R6029		1.2K ohms
R6030		12K ohms
R6031		1K ohms

(10) TN-2 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
VR6201	4-222V-14000	Channel Select VR.
SW6201	4-231V-19000	AFT Switch
		(TRANSISTORS)
Q6201		2SC536E or F
Q6202		2SC536E or F
Q6203		2SA984E or F
Q6204		2SA984E or F
		(DIODES)
D6201		DS442X or 1SS132
D6202		DS442X or 1SS132
D6203		DS442X or 1SS132
D6204		DS442X or 1SS132
D6205		DS442X or 1SS132
D6206		DS442X or 1SS132
D6207		DS442X or 1SS132
D6208		DS442X or 1SS132
D6215		DS442X or 1SS132
D6216		DS442X or 1SS132
D6217		DS442X or 1SS132
D6218		DS442X or 1SS132
D6219		DS442X or 1SS132
D6220		DS442X or 1SS132
D6221		DS442X or 1SS132
D6222		DS442X or 1SS132
D6229		μPC574J
D6230		1S1555 or 1S2473
D6232		1S1555 or 1S2473
		(CAPACITORS)
C6203		Elect., 22mfd (M), 50V
C6204		Ceramic, 0.01mfd (Z), 50V
C6205		Elect., 100mfd (M), 16V
C6206		Elect., 100mfd (M), 16V

Schematic Location	Parts No.	Description
		(RESISTORS)
R6201		470K ohms
R6202		39K ohms
R6203		1K ohms
R6204		100K ohms
R6205		1M ohms
R6206		10K ohms
R6207		15K ohms
R6208		2.2K ohms
R6209		2.2K ohms
R6210		2.2K ohms
R6211		15K ohms

(11) TN-3 PCB. ELECTRICAL PARTS

Schematic Location	Parts No.	Description
SW6301	4-231V-63500	Channel Select Switch
SW6302	4-231V-64000	POWER ON/TIMER/STAND BY Switch
	143-2-374T-01000	Panel, Channel Lights
		(DIODES)
D6301		LED, PR5704S ... Channel light
D6302		LED, PR5704S ... Channel light
D6303		LED, PR5704S ... Channel light
D6304		LED, PR5704S ... Channel light
D6305		LED, PR5704S ... Channel light
D6306		LED, PR5704S ... Channel light
D6307		LED, PR5704S ... Channel light
D6308		LED, PR5704S ... Channel light
D6309		LED, PR5704S ... POWER ON light
D6310		LED, PR5704S ... TIMER light
		(RESISTORS)
R6301		1K ohms
R6302		1K ohms
R6303		1K ohms
R6306		33K ohms
R6307		560 ohms

(12) TM-1 PCB. ELECTRICAL PARTS

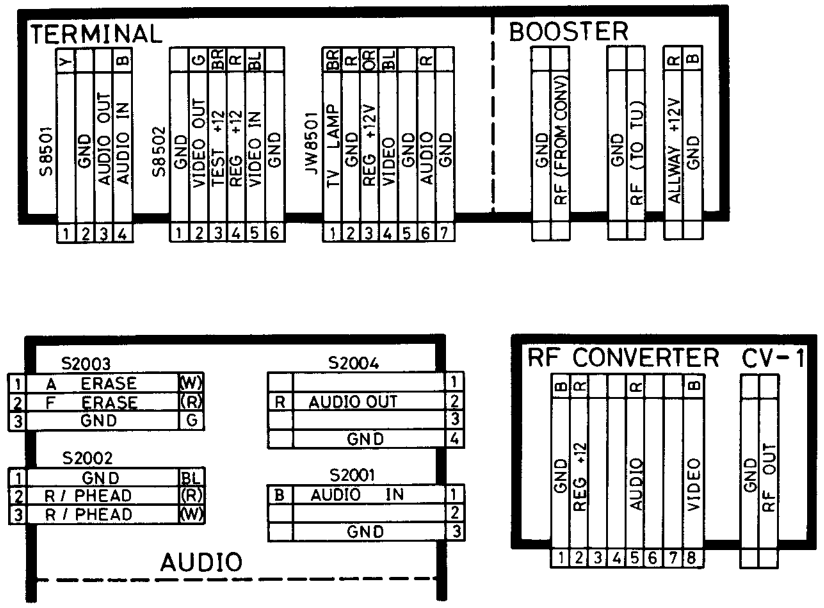
Schematic Location	Parts No.	Description
	4-202V-12700	Digital Display
CF7001	4-953V-03400	Ceramic Filter
SW7001	4-231V-64500	MEMORY Switch
SW7002	4-231V-64400	CLOCK SET Switch
SW7003	4-231V-64400	REC START Switch
SW7004	4-231V-64400	REC STOP Switch
SW7005	4-231V-64400	REC DAY Switch
SW7006	4-231V-64400	DAY/HOUR Switch
SW7007	4-231V-64400	MIN Switch
		(IC's & TRANSISTORS)
Q7001		IC, μPD552C-083
Q7002		IC, μPC393C
Q7003		2SB632E or F
Q7005		2SC536E or F
Q7006		2SC536E or F
Q7007		2SA608E or F
		(DIODE)
D7001		DS442 or 1S2473 or 1S1555
D7002		DS442 or 1S2473 or 1S1555
D7003		DS442 or 1S2473 or 1S1555
D7004		DS442 or 1S2473 or 1S1555
D7005		DS442 or 1S2473 or 1S1555
D7006		DS442 or 1S2473 or 1S1555
D7007		DS442 or 1S2473 or 1S1555
D7008		Zener, RD6.8EB2
D7009		Zener, RD11EB2
D7010		DS442 or 1S2473 or 1S1555
		(CAPACITORS)
C7001		Ceramic, 0.01mfd (M), 25V
C7002		Ceramic, 0.01mfd (M), 25V
C7003		Ceramic, 0.022mfd (M), 25V
C7004		Ceramic, 0.022mfd (M), 25V
C7005		Mylar, 0.082mfd (M), 50V
C7006		Elect., 100mfd (M), 25V
C7007		Elect., 47mfd (M), 25V
C7008		Ceramic, 470pF (K), 25V
C7009		Ceramic, 120pF (K), 25V
C7010		Ceramic, 0.022mfd (M), 25V
C7011		Elect., 33mfd (K), 16V
		(RESISTORS)
R7001		2.2K ohms
R7002		5.6K ohms
R7003		27K ohms
R7004		27K ohms
R7005		220K ohms
R7006		220K ohms
R7007		27K ohms
R7008		220K ohms
R7009		2.2K ohms
R7010		2.2K ohms
R7011		10K ohms
R7012		27K ohms
R7013		10K ohms
R7014		1K ohms
R7015		1M ohms
R7016		10K ohms
R7017		10K ohms
R7018		10K ohms
R7019		10K ohms
R7020		18K ohms
R7021		5.6K ohms
R7022		33K ohms
R7023		100K ohms
R7024		100K ohms
R7025		10K ohms
R7026	4-956V-10408	R-pack, 100K ohms × 8
R7027	4-956V-33305	R-pack, 33K ohms × 5
R7028	4-956V-33303	R-pack, 33K ohms × 3
R7029		10K ohms
R7030		10K ohms
R7031		33K ohms
R7032		10K ohms

VBS-7500(CONTINENT)
VBS-7500(Indonesia)
VBS-7500S
VBS-9900
VBS-9900S
VTC 5300P(CONTINENT)
VTC 5300P(U·K)
VTC 5300P(H·K)
VTC 5300P(South Africa)
VTC 5300P(Australia)
VTC 5300P(Indonesia)
VTC 5300PB
VTC 5300P(Ireland)

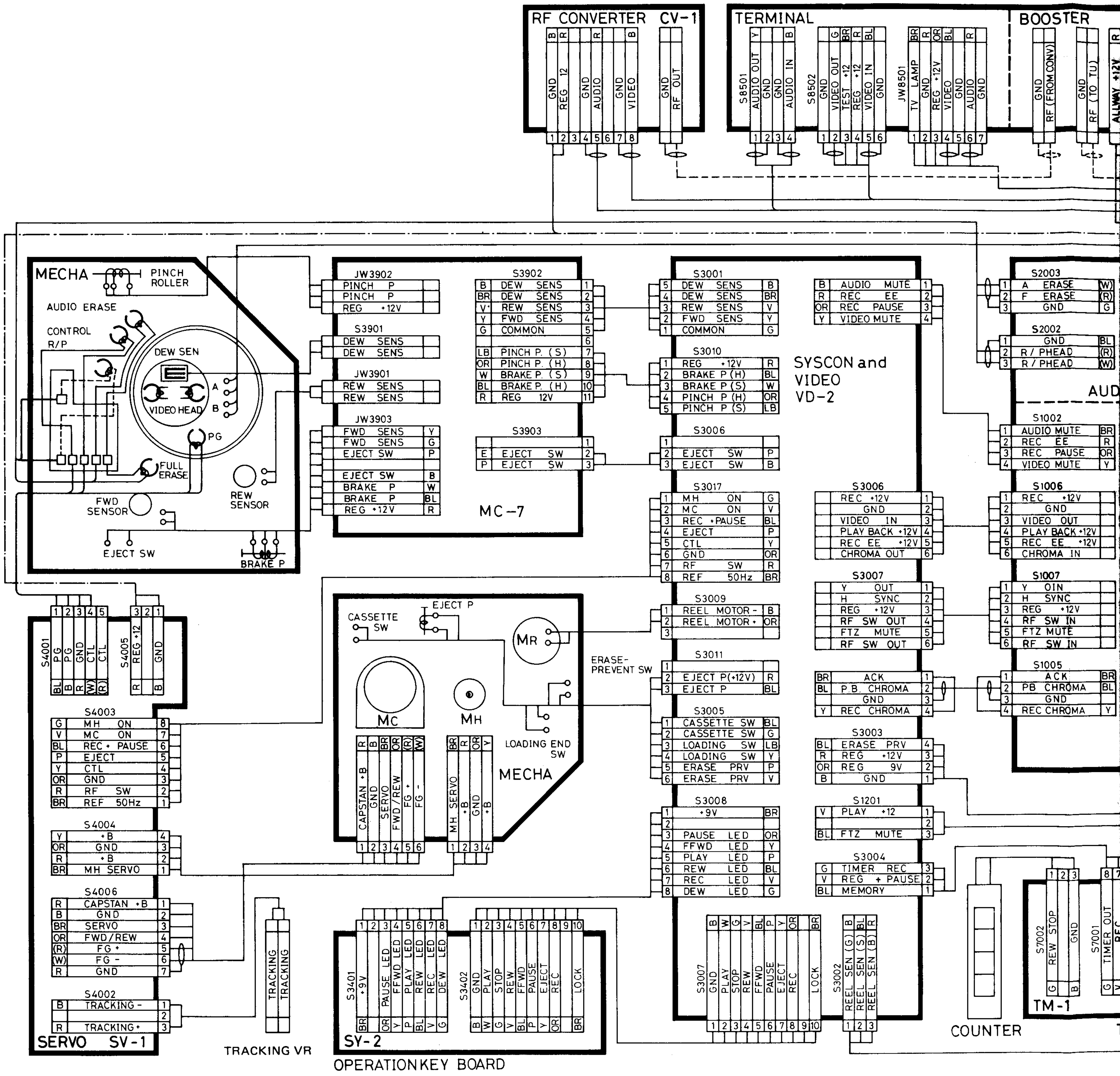
TABLE OF CONTENTS

OVER ALL WIRING DIAGRAM Ⓐ
P.C.B. VD-1 VIDEO (1) CIRCUIT
P.C.B. VD-3 VIDEO (3) CIRCUIT (STILL) Ⓑ
P.C.B. VD-1 VIDEO (1)/VIDEO-PRE/AUDIO
P.C.B. VD-1 AUDIO CIRCUIT Ⓒ
P.C.B. VD-1 VIDEO-PRE CIRCUIT
P.C.B. VD-2 SYSTEM CONTROL CIRCUIT Ⓓ
P.C.B. VD-2 VIDEO (2)/SYSTEM CONTROL
P.C.B. VD-2 VIDEO (2) CIRCUIT Ⓔ
P.C.B. SV-1 SERVO CIRCUIT
P.C.B. SV-2 CAPSTAN MOTOR CIRCUIT Ⓕ
P.C.B. SV-3 HEAD MOTOR CIRCUIT
P.C.B. TB-1 TERMINAL CIRCUIT
P.C.B. SY-2 OPERATION SWITCH CIRCUIT Ⓖ
P.C.B. MC-1 REEL SENSOR CIRCUIT
P.C.B. TM-1 TIMER CIRCUIT
P.C.B. TN-1 I.F CIRCUIT Ⓗ
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT CIRCUIT Ⓘ
P.C.B. PW-1.2 POWER SUPPLY CIRCUIT Ⓙ

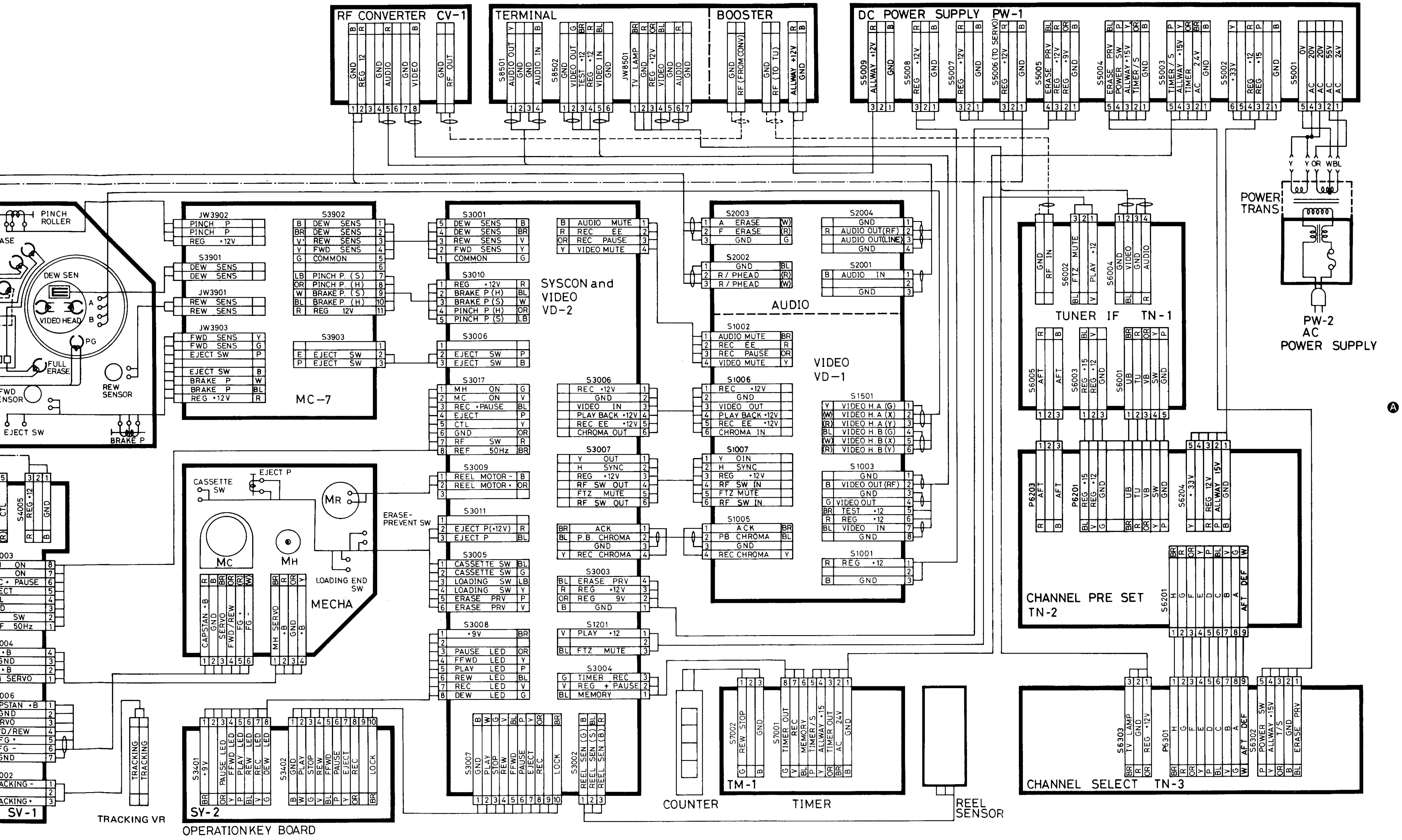
OVER ALL WIRING DIAGRAM (SUPPLEMENT)


TERMINAL
S8501
GND
AUDIO OUT
AUDIO IN
S8502
GND
VIDEO OUT
TEST +12
REG +12
VIDEO IN
GND
JW8501
TV LAMP
GND
REG +12V
VIDEO
GND
AUDIO
GND
BOOSTER
GND
RF (FROM CONV)
GND
RF (TO TU)
ALLWAY +12V
GND
S2003
A ERASE
F ERASE
GND
S2004
AUDIO OUT
GND
S2002
GND
R / PHEAD
R / PHEAD
S2001
AUDIO IN
GND
AUDIO
RF CONVERTER CV-1
GND
REG +12
AUDIO
VIDEO
GND
RF OUT

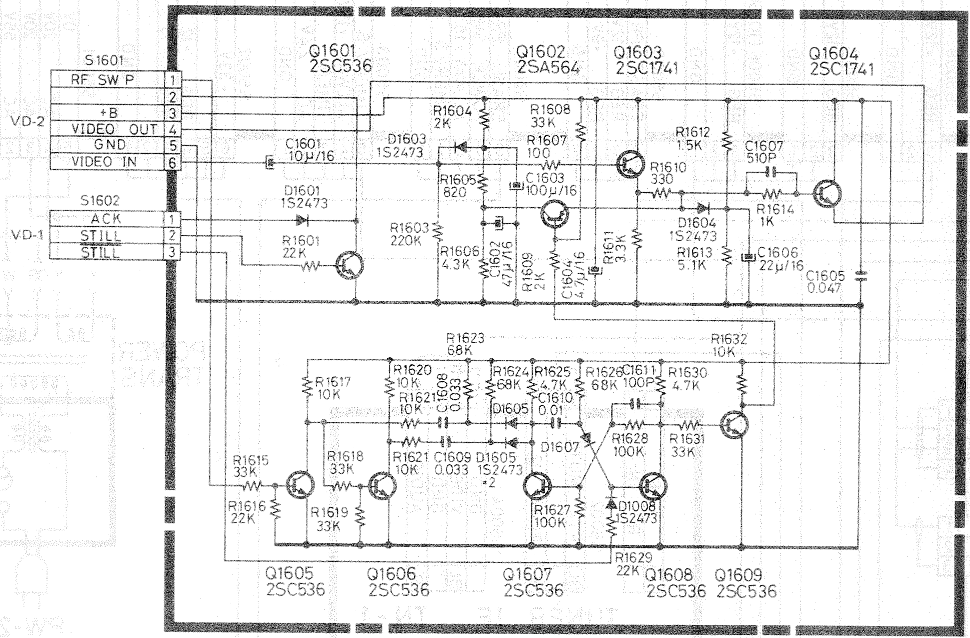
OVER ALL WIRING DIAGRAM


RF CONVERTER CV-1
GND
REG 12
GND
AUDIO
GND
VIDEO
GND
RF OUT
TERMINAL
S8501
AUDIO OUT
GND
AUDIO IN
S8502
VIDEO OUT
TEST +12
REG +12
VIDEO IN
GND
JW8501
TV LAMP
GND
REG +12V
VIDEO
GND
AUDIO
BOOSTER
GND
RF (FROM CONV)
GND
RF (TO TU)
ALLWAY +12V
MECHA
PINCH ROLLER
AUDIO ERASE
CONTROL R/P
DEW SEN
VIDEO HEAD
A
B
PG
FULL ERASE
FWD SENSOR
REW SENSOR
EJECT SW
BRAKE P
JW3902
PINCH P
PINCH P
REG +12V
S3901
DEW SENS
DEW SENS
JW3901
REW SENS
REW SENS
JW3903
FWD SENS
FWD SENS
EJECT SW
EJECT SW
BRAKE P
BRAKE P
REG +12V
S3902
DEW SENS
DEW SENS
REW SENS
FWD SENS
COMMON
PINCH P. (S)
PINCH P. (H)
BRAKE P. (S)
BRAKE P. (H)
REG 12V
S3903
EJECT SW
EJECT SW
MC-7
S3001
DEW SENS
DEW SENS
REW SENS
FWD SENS
COMMON
S3010
REG +12V
BRAKE P (H)
BRAKE P (S)
PINCH P (H)
PINCH P (S)
S3006
EJECT SW
EJECT SW
S3017
MH ON
MC ON
REC • PAUSE
EJECT
CTL
GND
RF SW
REF 50Hz
S3009
REEL MOTOR -
REEL MOTOR +
S3011
EJECT P(+12V)
EJECT P
S3005
CASSETTE SW
CASSETTE SW
LOADING SW
LOADING SW
ERASE PRV
ERASE PRV
S3008
+9V
PAUSE LED
FFWD LED
PLAY LED
REW LED
REC LED
DEW LED
SYSCON and VIDEO VD-2
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
S3006
REC +12V
GND
VIDEO IN
PLAY BACK +12V
REC EE +12V
CHROMA OUT
S3007
Y OUT
H SYNC
REG +12V
RF SW OUT
FTZ MUTE
RF SW OUT
ACK
P.B. CHROMA
GND
REC CHROMA
S3003
ERASE PRV
REG +12V
REG 9V
GND
S1201
PLAY +12
FTZ MUTE
S3004
TIMER REC
REG + PAUSE
MEMORY
S3007
GND
PLAY
STOP
REW
FFWD
PAUSE
EJECT
REC
LOCK
S3002
REEL SEN (G)
REEL SEN (S)
REEL SEN (B)
S2003
A ERASE
F ERASE
GND
S2002
GND
R / PHEAD
R / PHEAD
AUD
S1002
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
S1006
REC +12V
GND
VIDEO OUT
PLAY BACK +12V
REC EE +12V
CHROMA IN
S1007
Y OIN
H SYNC
REG +12V
RF SW IN
FTZ MUTE
RF SW IN
S1005
ACK
PB CHROMA
GND
REC CHROMA
COUNTER
S7002
REW STOP
GND
S7001
TIMER OUT
TM-1
S4001
PG
PG
GND
CTL
CTL
S4005
REG +12
GND
S4003
MH ON
MC ON
REC • PAUSE
EJECT
CTL
GND
RF SW
REF 50Hz
S4004
+B
GND
+B
MH SERVO
S4006
CAPSTAN +B
GND
SERVO
FWD/REW
FG +
FG -
GND
S4002
TRACKING -
TRACKING +
SERVO SV-1
TRACKING
TRACKING
TRACKING VR
CASSETTE SW
EJECT P
MR
MC
MH
CAPSTAN +B
GND
SERVO
FWD/REW
FG +
FG -
MH SERVO
+B
GND
+B
LOADING END SW
MECHA
ERASE-PREVENT SW
S3401
+9V
PAUSE LED
FFWD LED
PLAY LED
REW LED
REC LED
DEW LED
S3402
GND
PLAY
STOP
REW
FFWD
PAUSE
EJECT
REC
LOCK
SY-2
OPERATION KEY BOARD

OVER ALL WIRING DIAGRAM

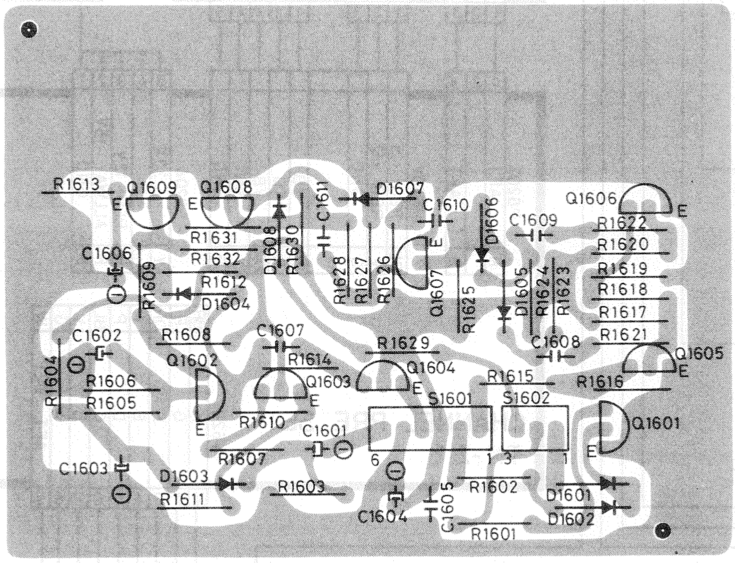

RF CONVERTER CV-1
GND
REG 12
GND
AUDIO
GND
VIDEO
GND
RF OUT
TERMINAL
S8501
AUDIO OUT
GND
GND
AUDIO IN
S8502
GND
VIDEO OUT
TEST +12
REG +12
VIDEO IN
GND
JW8501
TV LAMP
GND
REG +12V
VIDEO
GND
AUDIO
GND
BOOSTER
GND
RF (FROM CONV)
GND
RF (TO TU)
ALLWAY +12V
GND
DC POWER SUPPLY PW-1
S5009
ALLWAY +12V
GND
S5008
REG +12V
GND
S5007
REG +12V
GND
S5006 (TO SERVO)
REG +12V
GND
S5005
ERASE PRV
REG +12V
REG +9V
GND
S5004
ERASE PRV
POWER SW
ALLWAY +15V
TIMER/S
GND
S5003
TIMER/S
ALLWAY +15V
TIMER
AC 24V
GND
S5002
+33V
REG +12
REG +15
GND
S5001
0V
AC 20V
AC 20V
AC 55V
AC 24V
POWER TRANS
PW-2
AC POWER SUPPLY
PINCH ROLLER
DEW SEN
VIDEO HEAD
A
B
PG
FULL ERASE
FWD SENSOR
REW SENSOR
EJECT SW
BRAKE P
JW3902
PINCH P
PINCH P
REG +12V
S3901
DEW SENS
DEW SENS
JW3901
REW SENS
REW SENS
JW3903
FWD SENS
FWD SENS
EJECT SW
EJECT SW
BRAKE P
BRAKE P
REG +12V
S3902
DEW SENS
DEW SENS
REW SENS
FWD SENS
COMMON
PINCH P. (S)
PINCH P. (H)
BRAKE P. (S)
BRAKE P. (H)
REG 12V
S3903
EJECT SW
EJECT SW
MC-7
CASSETTE SW
EJECT P
MR
MC
MH
ERASE-PREVENT SW
LOADING END SW
MECHA
CAPSTAN +B
GND
SERVO
FWD/REW
FG +
FG -
MH SERVO
+B
GND
+B
S3001
DEW SENS
DEW SENS
REW SENS
FWD SENS
COMMON
S3010
REG +12V
BRAKE P (H)
BRAKE P (S)
BRAKE P (H)
PINCH P (H)
PINCH P (S)
S3006
EJECT SW
EJECT SW
S3017
MH ON
MC ON
REC +PAUSE
EJECT
CTL
GND
RF SW
REF 50Hz
S3009
REEL MOTOR -
REEL MOTOR +
S3011
EJECT P(+12V)
EJECT P
S3005
CASSETTE SW
CASSETTE SW
LOADING SW
LOADING SW
ERASE PRV
ERASE PRV
S3008
+9V
PAUSE LED
FFWD LED
PLAY LED
REW LED
REC LED
DEW LED
SYSCON and VIDEO VD-2
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
S3006
REC +12V
GND
VIDEO IN
PLAY BACK +12V
REC EE +12V
CHROMA OUT
S3007
Y OUT
H SYNC
REG +12V
RF SW OUT
FTZ MUTE
RF SW OUT
ACK
P.B. CHROMA
GND
REC CHROMA
S3003
ERASE PRV
REG +12V
REG 9V
GND
S1201
PLAY +12
FTZ MUTE
S3004
TIMER REC
REG + PAUSE
MEMORY
S3007
GND
PLAY
STOP
REW
FFWD
PAUSE
EJECT
REC
LOCK
S3002
REEL SEN (G)
REEL SEN (S)
REEL SEN (B)
S2003
A ERASE
F ERASE
GND
S2002
GND
R/PHEAD
R/PHEAD
S2004
GND
AUDIO OUT(RF)
AUDIO OUT(LINE)
GND
S2001
AUDIO IN
GND
AUDIO
S1002
AUDIO MUTE
REC EE
REC PAUSE
VIDEO MUTE
S1006
REC +12V
GND
VIDEO OUT
PLAY BACK +12V
REC EE +12V
CHROMA IN
S1007
Y OIN
H SYNC
REG +12V
RF SW IN
FTZ MUTE
RF SW IN
S1005
ACK
PB CHROMA
GND
REC CHROMA
VIDEO VD-1
S1501
VIDEO H.A (G)
VIDEO H.A (X)
VIDEO H.A (Y)
VIDEO H.B (G)
VIDEO H.B (X)
VIDEO H.B (Y)
S1003
GND
VIDEO OUT (RF)
GND
VIDEO OUT
TEST +12
REG +12
VIDEO IN
GND
S1001
REG +12
GND
GND
RF IN
S6002
FTZ MUTE
PLAY +12
S6004
GND
VIDEO
GND
AUDIO
TUNER IF TN-1
S6005
AFT
AFT
S6003
REG +15
REG +12
GND
S6001
UB
TU
VB
SW
GND
P6203
AFT
AFT
P6201
REG +15
REG +12
GND
UB
TU
VB
SW
GND
S6204
+33V
REG 12V
ALLWAY 15V
GND
CHANNEL PRE SET TN-2
S6201
H
G
F
E
D
C
B
A
AFT DEF
S3401
+9V
PAUSE LED
FFWD LED
PLAY LED
REW LED
REC LED
DEW LED
S3402
GND
PLAY
STOP
REW
FFWD
PAUSE
EJECT
REC
LOCK
SY-2
OPERATIONKEY BOARD
TRACKING
TRACKING
TRACKING VR
S4005
REG +12
GND
CTL
ON
ON
REC + PAUSE
EJECT
CTL
GND
RF SW
REF 50Hz
+B
GND
+B
SERVO
CAPSTAN +B
GND
SERVO
FWD/REW
FG +
FG -
GND
TRACKING -
TRACKING +
SV-1
COUNTER
S7002
REW STOP
GND
S7001
TIMER OUT
REC
MEMORY
TIMER/S
ALLWAY +15
TIMER OUT
AC 24V
GND
TM-1
TIMER
REEL SENSOR
S6303
TV LAMP
GND
REG +12V
P6301
H
G
F
E
D
C
B
A
AFT DEF
S6302
POWER SW
ALLWAY +15V
T/S
GND
ERASE PRV
CHANNEL SELECT TN-3
Ⓐ

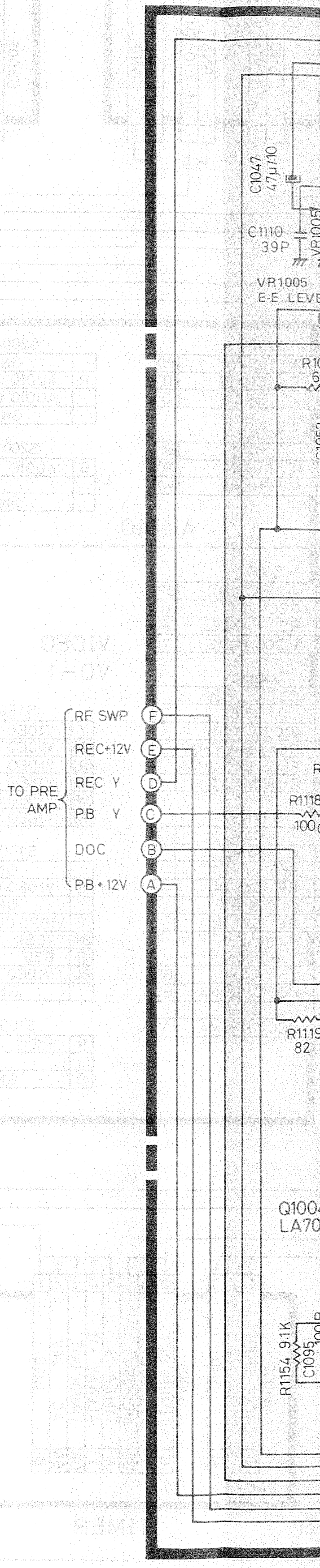
P.C.B. VD-3 VIDEO (3) CIRCUIT (STILL)


S1601
RF SW P
+B
VIDEO OUT
GND
VIDEO IN
VD-2
S1602
ACK
STILL
STILL
VD-1
Q1601 2SC536
Q1602 2SA564
Q1603 2SC1741
Q1604 2SC1741
R1604 2K
R1608 33K
R1607 100
D1603 1S2473
C1601 10μ/16
D1601 1S2473
R1601 22K
R1605 820
C1603 100μ/16
R1603 220K
R1606 4.3K
C1602 47μ/16
R1609 2K
C1604 4.7μ/16
R1611 3.3K
R1612 1.5K
R1610 330
C1607 510P
R1614 1K
D1604 1S2473
R1613 5.1K
C1606 22μ/16
C1605 0.047
R1623 68K
R1632 10K
R1617 10K
R1620 10K
R1621 10K
C1608 0.033
R1624 68K
R1625 4.7K
D1605
C1610 0.01
R1626 68K
C1611 100P
R1630 4.7K
D1607
R1628 100K
R1631 33K
R1615 33K
R1618 33K
R1621 10K
C1609 0.033
D1605 1S2473 ×2
R1616 22K
R1619 33K
R1627 100K
D1008 1S2473
R1629 22K
Q1605 2SC536
Q1606 2SC536
Q1607 2SC536
Q1608 2SC536
Q1609 2SC536

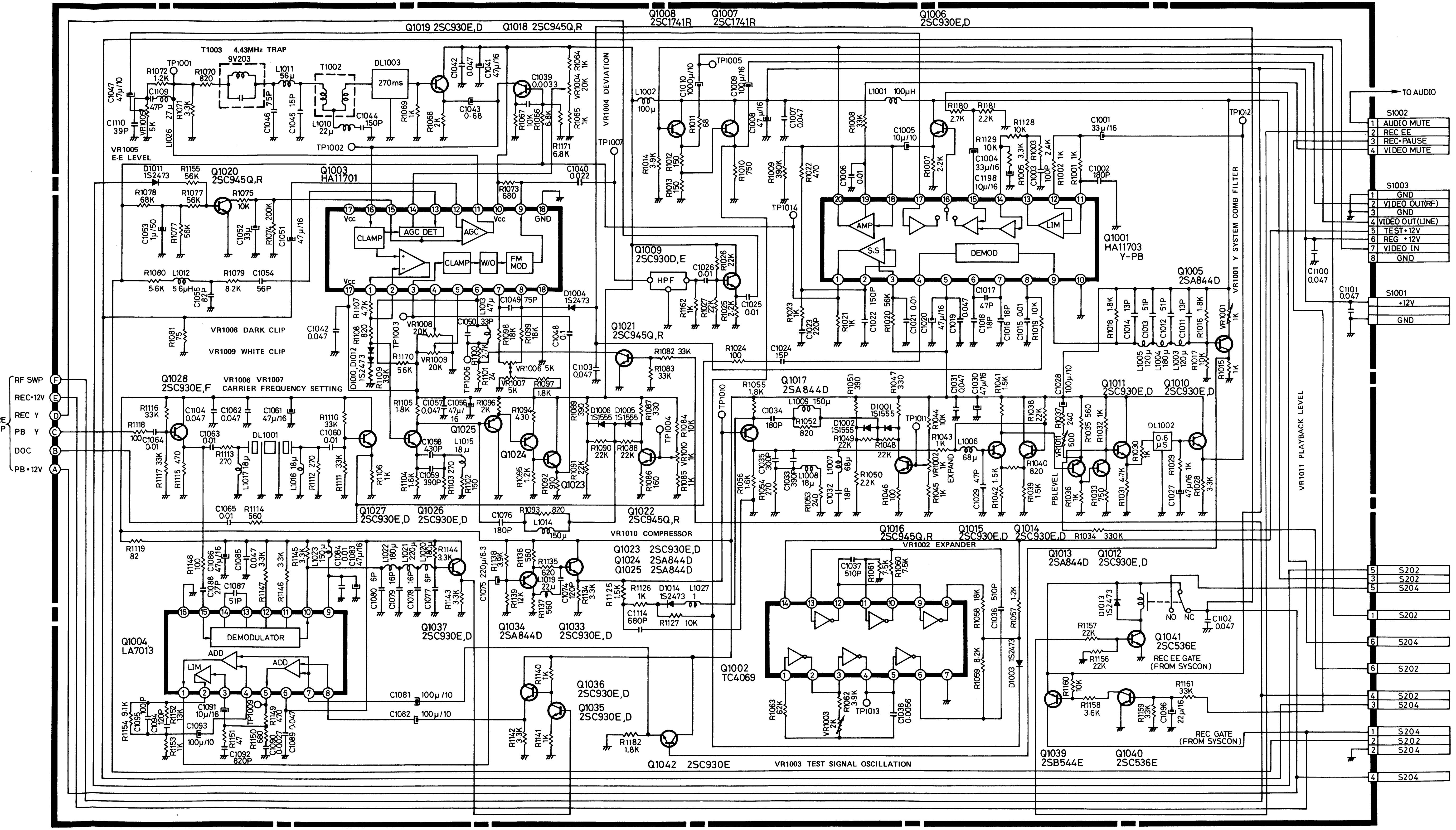
P.C.B. VD-3 VIDEO (3) CIRCUIT (STILL)

Ⓑ


R1613
Q1609
Q1608
D1607
C1611
C1610
D1606
Q1606
C1609
R1622
R1620
R1619
R1618
R1617
R1621
Q1605
R1616
C1606
R1631
R1632
D1608
R1630
R1628
R1627
R1626
Q1607
R1625
D1605
R1624
R1623
C1608
R1609
R1612
D1604
C1602
R1608
C1607
R1629
R1604
Q1602
R1614
Q1603
Q1604
R1615
R1606
R1605
S1601
S1602
Q1601
R1610
C1601
R1607
C1603
D1603
R1603
R1602
R1611
C1605
C1604
R1601
D1601
D1602
E
6
1
3
1

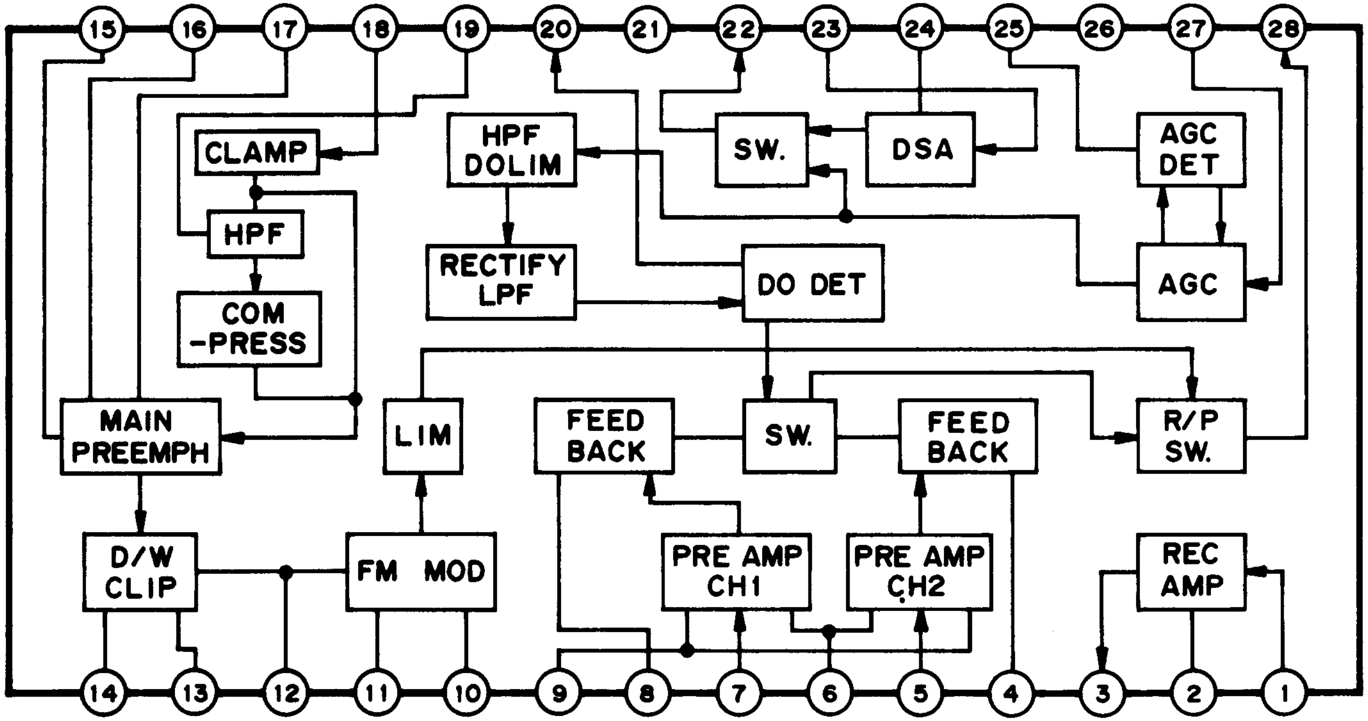

C1047 47μ/10
C1110 39P
VR1005
VR1005 E-E LEVE
R1118 100
R1119 82
TO PRE AMP
RF SWP
REC+12V
REC Y
PB Y
DOC
PB+12V
F
E
D
C
B
A
Q1004 LA70
R1154 9.1K
C1095

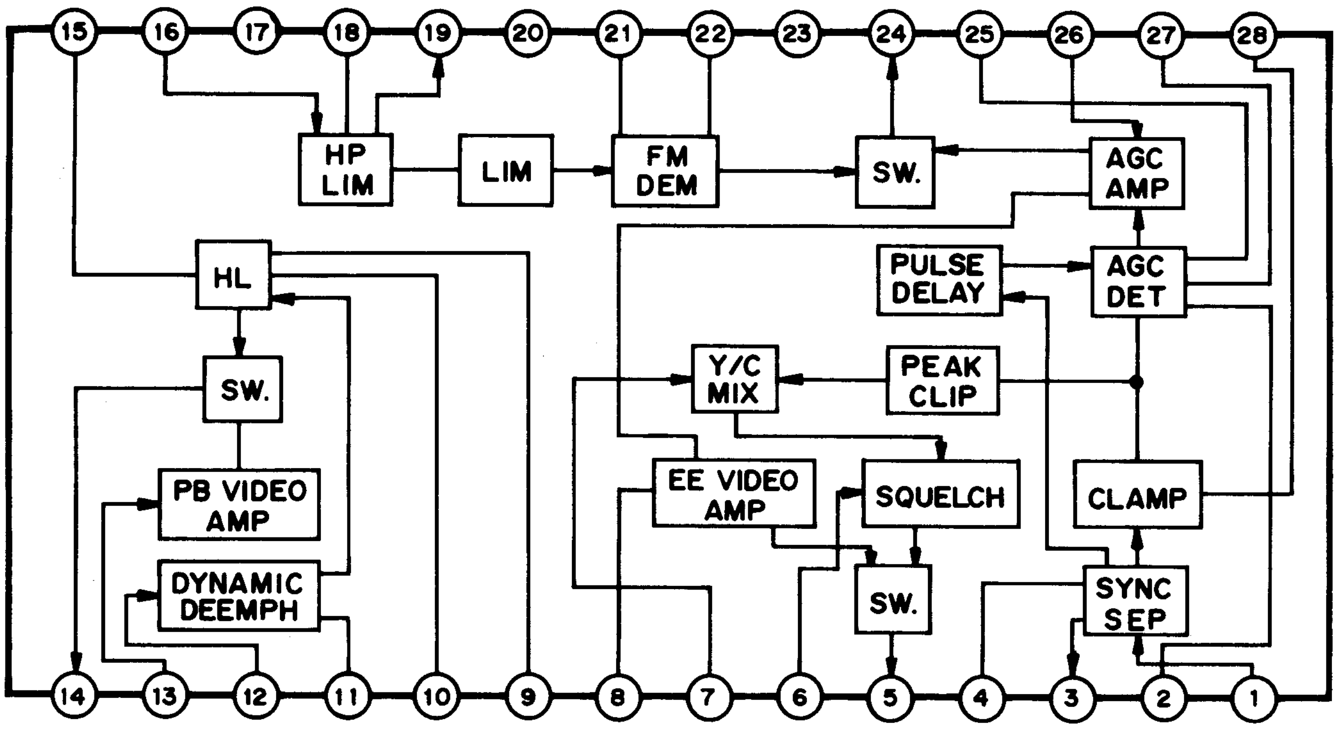
P.C.B. VD-1 VIDEO (1) CIRCUIT


Q1019 2SC930E,D
Q1018 2SC945Q,R
Q1008 2SC1741R
Q1007 2SC1741R
Q1006 2SC930E,D
T1003 4.43MHz TRAP
9V203
T1002
DL1003 270ms
TP1001
TP1002
TP1005
TP1007
TP1012
TP1014
VR1004 DEVIATION
VR1005 E-E LEVEL
Q1020 2SC945Q,R
Q1003 HA11701
CLAMP
AGC DET
AGC
CLAMP
W/O
FM MOD
Vcc
GND
Q1009 2SC930D,E
HPF
Q1001 HA11703 Y-PB
AMP
S.S
LIM
DEMOD
Q1005 2SA844D
VR1001 Y SYSTEM COMB FILTER
TO AUDIO
S1002
1 AUDIO MUTE
2 REC EE
3 REC•PAUSE
4 VIDEO MUTE
S1003
1 GND
2 VIDEO OUT(RF)
3 GND
4 VIDEO OUT(LINE)
5 TEST•12V
6 REG •12V
7 VIDEO IN
8 GND
S1001
+12V
GND
VR1008 DARK CLIP
VR1009 WHITE CLIP
D1004 1S2473
D1011 1S2473
D1010,D1012 1S2473
Q1021 2SC945Q,R
Q1028 2SC930E,F
VR1006 VR1007 CARRIER FREQUENCY SETTING
RF SWP
REC•12V
REC Y
PB Y
DOC
PB•12V
PRE AMP
F
E
D
C
B
A
DL1001
Q1025
Q1024
Q1023
Q1027 2SC930E,D
Q1026 2SC930E,D
Q1022 2SC945Q,R
VR1010 COMPRESSOR
Q1023 2SC930E,D
Q1024 2SA844D
Q1025 2SA844D
Q1017 2SA844D
D1001 1S1555
D1002 1S1555
D1005 1S1555
D1006 1S1555
TP1010
TP1011
TP1006
TP1003
TP1004
EXPAND
PBLEVEL
DL1002 0.6 μS
Q1011 2SC930E,D
Q1010 2SC930E,D
VR1011 PLAYBACK LEVEL
Q1016 2SC945Q,R
Q1015 2SC930E,D
Q1014 2SC930E,D
VR1002 EXPANDER
Q1013 2SA844D
Q1012 2SC930E,D
Q1004 LA7013
DEMODULATOR
LIM
ADD
ADD
Q1037 2SC930E,D
Q1034 2SA844D
Q1033 2SC930E,D
D1014 1S2473
Q1002 TC4069
TP1009
TP1013
D1003 1S2473
D1013 1S2473
NO
NC
Q1041 2SC536E
REC EE GATE (FROM SYSCON)
Q1036 2SC930E,D
Q1035 2SC930E,D
Q1042 2SC930E
VR1003 TEST SIGNAL OSCILLATION
REC GATE (FROM SYSCON)
Q1039 2SB544E
Q1040 2SC536E
S202
S204

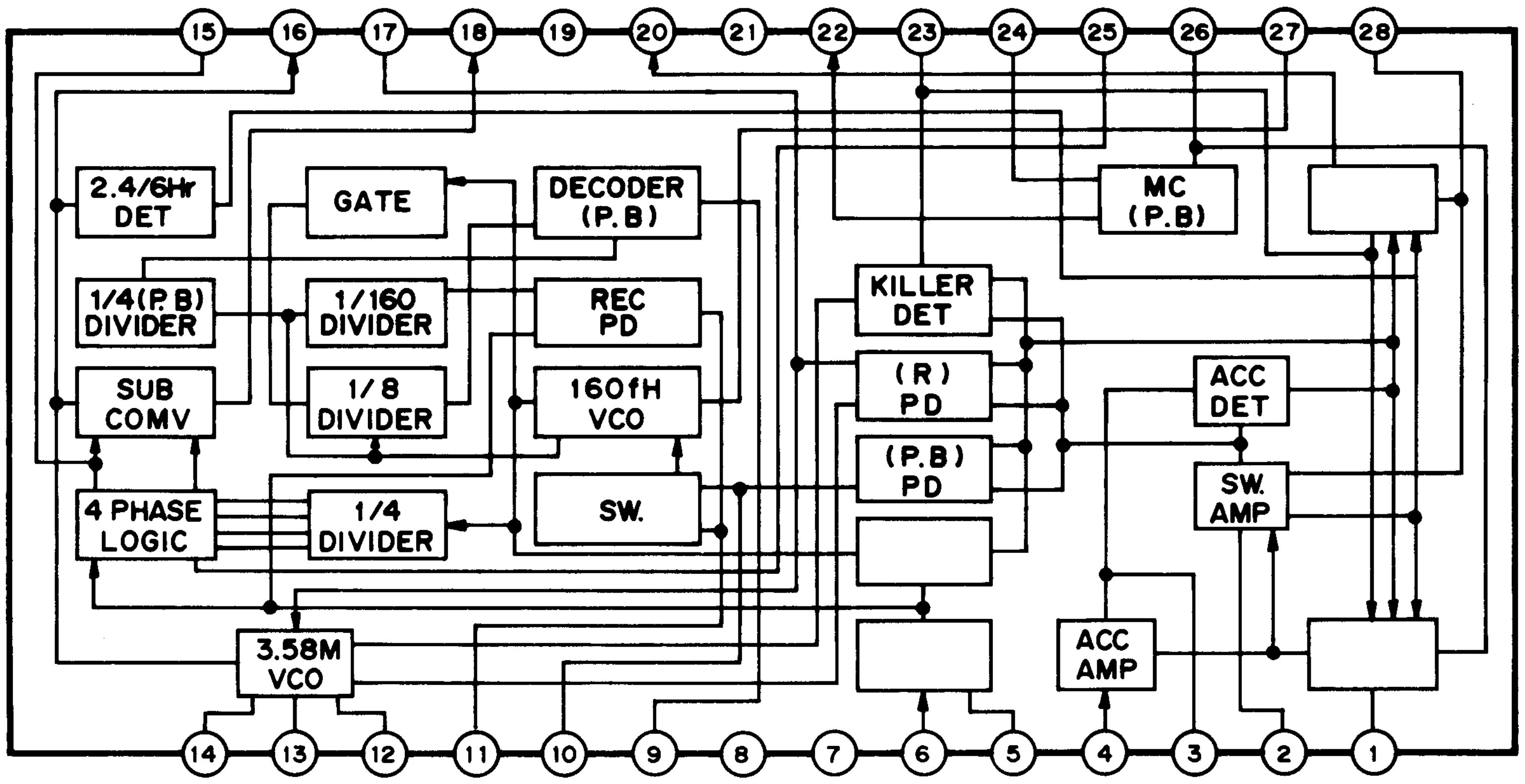
VIDEO CIRCUIT IC BLOCK DIAGRAM

IC201 HA11724


15
16
17
18
19
20
21
22
23
24
25
26
27
28
CLAMP
HPF
COM -PRESS
MAIN PREEMPH
HPF DOLIM
RECTIFY LPF
SW.
DSA
DO DET
AGC DET
AGC
LIM
FEED BACK
SW.
FEED BACK
R/P SW.
D/W CLIP
FM MOD
PRE AMP CH1
PRE AMP CH2
REC AMP
14
13
12
11
10
9
8
7
6
5
4
3
2
1

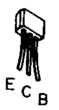

15
16
17
18
19
20
21
22
23
24
25
26
27
28
HP LIM
LIM
FM DEM
SW.
AGC AMP
PULSE DELAY
AGC DET
HL
SW.
Y/C MIX
PEAK CLIP
PB VIDEO AMP
EE VIDEO AMP
SQUELCH
CLAMP
DYNAMIC DEEMPH
SW.
SYNC SEP
14
13
12
11
10
9
8
7
6
5
4
3
2
1

IC202 HA11725

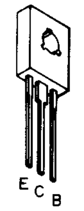

15
16
17
18
19
20
21
22
23
24
25
26
27
28
2.4/6Hr DET
GATE
DECODER (P.B)
MC (P.B)
1/4(P.B) DIVIDER
1/160 DIVIDER
REC PD
KILLER DET
SUB COMV
1/8 DIVIDER
160fH VCO
(R) PD
ACC DET
(P.B) PD
SW. AMP
4 PHASE LOGIC
1/4 DIVIDER
SW.
3.58M VCO
ACC AMP
14
13
12
11
10
9
8
7
6
5
4
3
2
1

IC203 HA11741

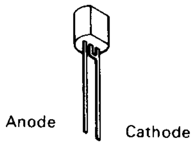
TERMINAL VIEW



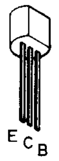
2SA608SP
2SC536SP
2SC2458



2SA612
2SC496
2SC1449
2SD894

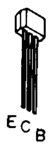

Anode
Cathode

MPC574J

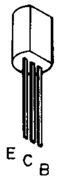


2SA608NP
2SA733
2SA817
2SA950
2SA952
2SA953
2SA953K

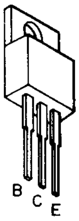
2SA984
2SA984K
2SA1015
2SA1016
2SA1198
2SB698
2SC536NP
2SC945
2SC1627
2SC1652
2SC1815
2SC2002
2SC2274
2SC2363
2SC2785
2SD545
2SD734



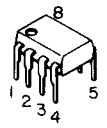
2SB810



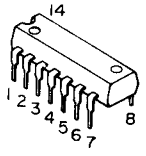
2SA400
2SA965
2SB560
2SC2236



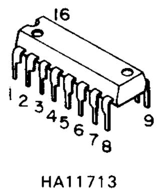
2SD313
2SD568
2SD613



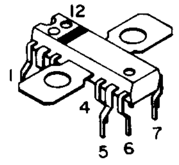
LA6458DF


14
1
2
3
4
5
6
7
8

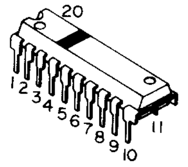
HA11722
LC4013
LC4069
LC4081


16
1
2
3
4
5
6
7
8
9

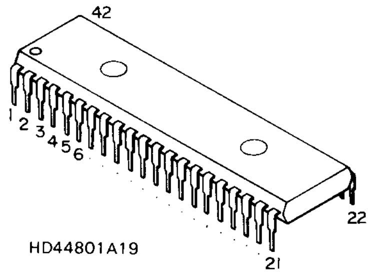
HA11713
HD14506



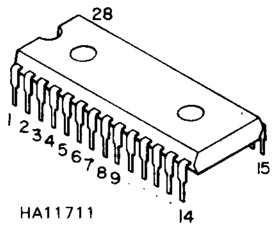
HA11715


20
1
2
3
4
5
6
7
8
9
10
11

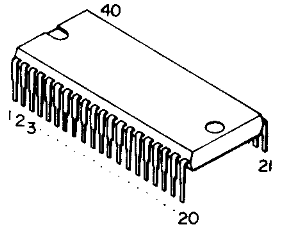
HA11714


42
1
2
3
4
5
6
22
21

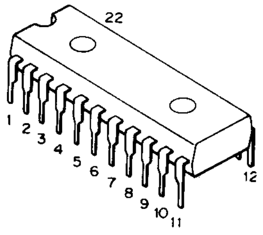
HD44801A19


28
1
2
3
4
5
6
7
8
9
15
14

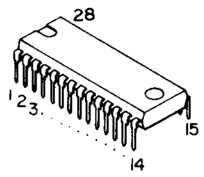
HA11711
HA11724
HA11725
HA11741
HD38701A06



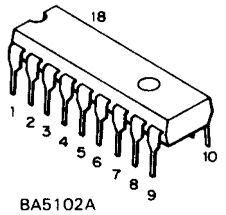
SPT2300L02


22
1
2
3
4
5
6
7
8
9
10
11
12

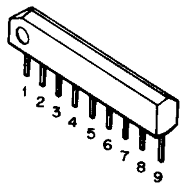
LA7810



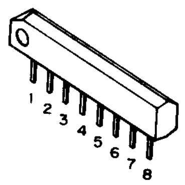
TMS1024NHL


18
1
2
3
4
5
6
7
8
9
10

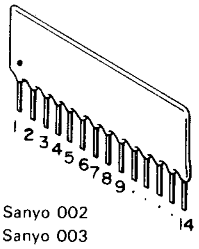
BA5102A
LA7040



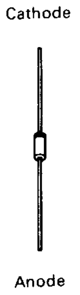
LA7905



LA7016

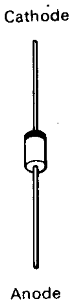

1
2
3
4
5
6
7
8
9
14

Sanyo 002
Sanyo 003
Sanyo 004

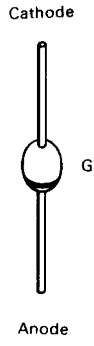

Cathode
Anode

1S2076
DS442
EQA02-06
EQA02-08
EQA02-09
EQA02-10
EQA02-16

EQA02-23
EQA02-35
GZA5.1
GZA6.2
GZA8.2
GZA10
GZA16
GZA22
GZA36
GZA39E
GZA91
RD6.2E
RD8.2E
RD10E
RD11E
RD16E
RD24E
RD39E
RD51E


Cathode
Anode

DS135E
ERB12-02

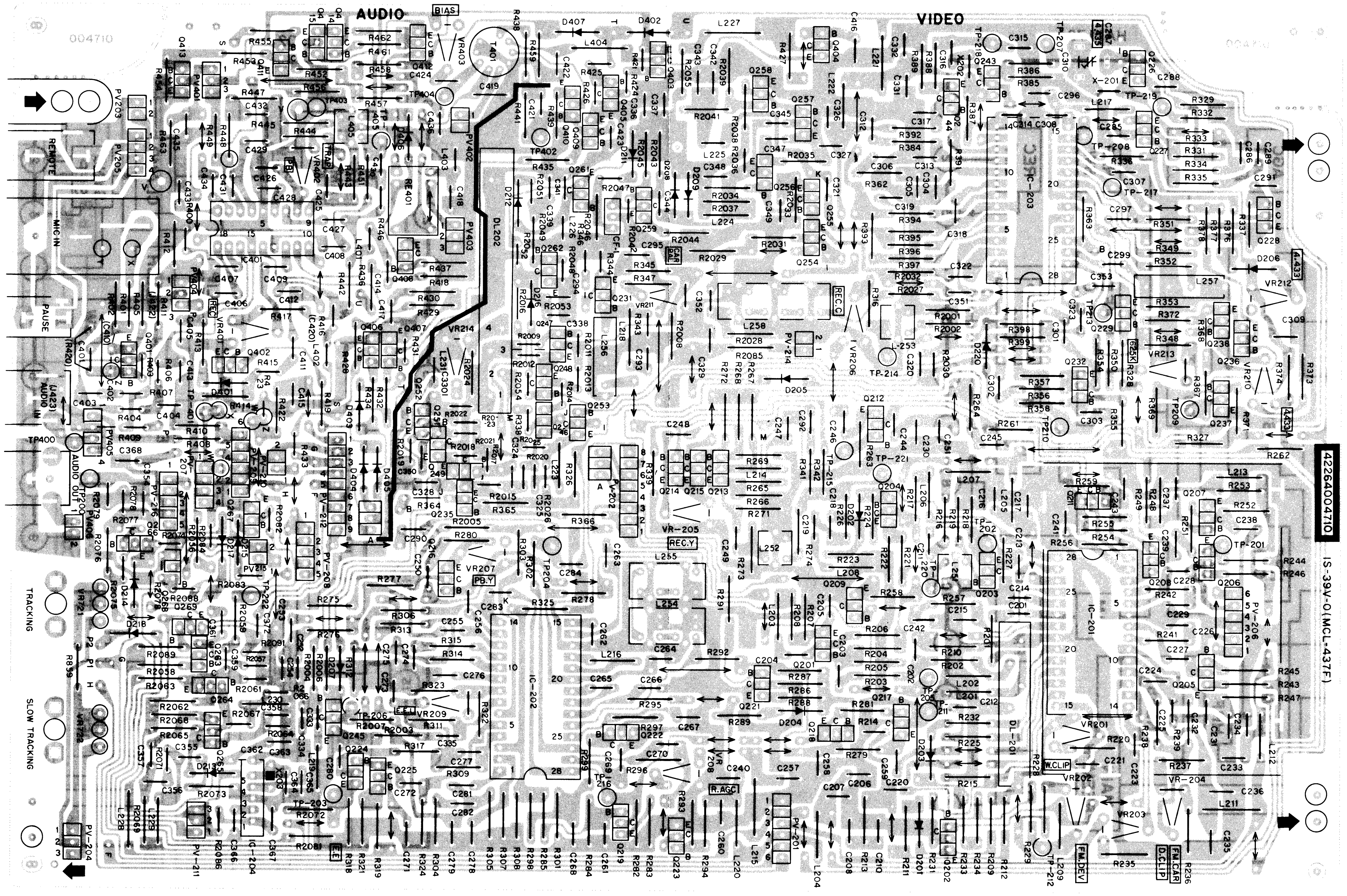

Cathode
Anode

GSA30C

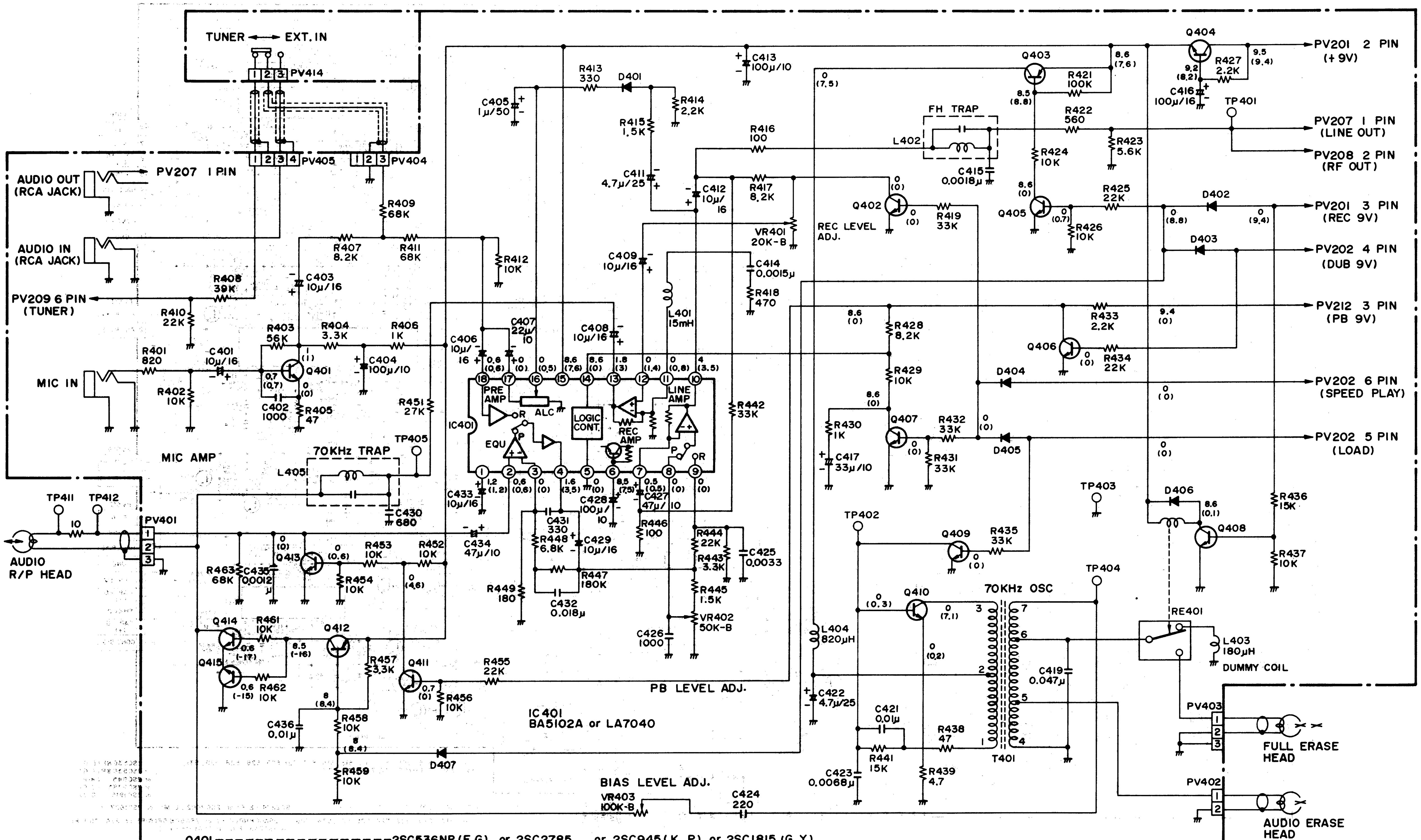
NOTES. B : Base C : Collector E : Emitter

Ⓓ

VIDEO AUDIO P.C.B.


AUDIO
VIDEO
BIAS
REMOTE
MIC IN
PAUSE
AUDIO IN
AUDIO OUT
TP400
TRACKING
SLOW TRACKING
REC.C
REC.Y
PB.Y
R.AGC
W.CLIP
FM.DEV
FM.CAR
D.CLIP
IC-201
IC-202
IC-203
IC401
DL-201
DL202
4226400471O
IS-39V-0(MCL-437F)

AUDIO CIRCUIT DIAGRAM


TUNER ◄—► EXT. IN
PV414
PV405
PV404
AUDIO OUT (RCA JACK)
PV207 1 PIN
AUDIO IN (RCA JACK)
PV209 6 PIN (TUNER)
MIC IN
MIC AMP
70KHz TRAP
L405
TP405
TP411
TP412
PV401
AUDIO R/P HEAD
Q401
Q402
Q403
Q404
Q405
Q406
Q407
Q408
Q409
Q410
Q411
Q412
Q413
Q414
Q415
IC401
PRE AMP
ALC
LOGIC CONT.
REC AMP
LINE AMP
EQU
IC401 BA5102A or LA7040
FH TRAP
L402
REC LEVEL ADJ.
VR401 20K-B
L401 15mH
PB LEVEL ADJ.
VR402 50K-B
BIAS LEVEL ADJ.
VR403 100K-B
70KHz OSC
T401
L404 820μH
TP401
TP402
TP403
TP404
RE401
L403 180μH
DUMMY COIL
PV403
FULL ERASE HEAD
PV402
AUDIO ERASE HEAD
PV201 2 PIN (+9V)
PV207 1 PIN (LINE OUT)
PV208 2 PIN (RF OUT)
PV201 3 PIN (REC 9V)
PV202 4 PIN (DUB 9V)
PV212 3 PIN (PB 9V)
PV202 6 PIN (SPEED PLAY)
PV202 5 PIN (LOAD)
D401
D402
D403
D404
D405
D406
D407

Q401——————————2SC536NP(F,G) or 2SC2785 or 2SC945(K,P) or 2SC1815(G,Y)
Q402, 405, 406, 407, 409, 411———2SC536NP(F,G) or 2SC536SP(F,G) or 2SC2785 or 2SC945(K,P) or 2SC1815(G,Y) or 2SA608(F,G)
Q403——————————2SB698(F,G) or 2SA952(L,M) or 2SA950(O,Y)
Q404, 408———————2SC2274(E,F) or 2SC2002(L,M)
Q410——————————2SD734(F,G)
Q412——————————2SA1016(F,G)
Q413——————————2SD545(E,F)

Q414, 415———2SC3071
D401~D407——DS442 or IS2076

NOTES:

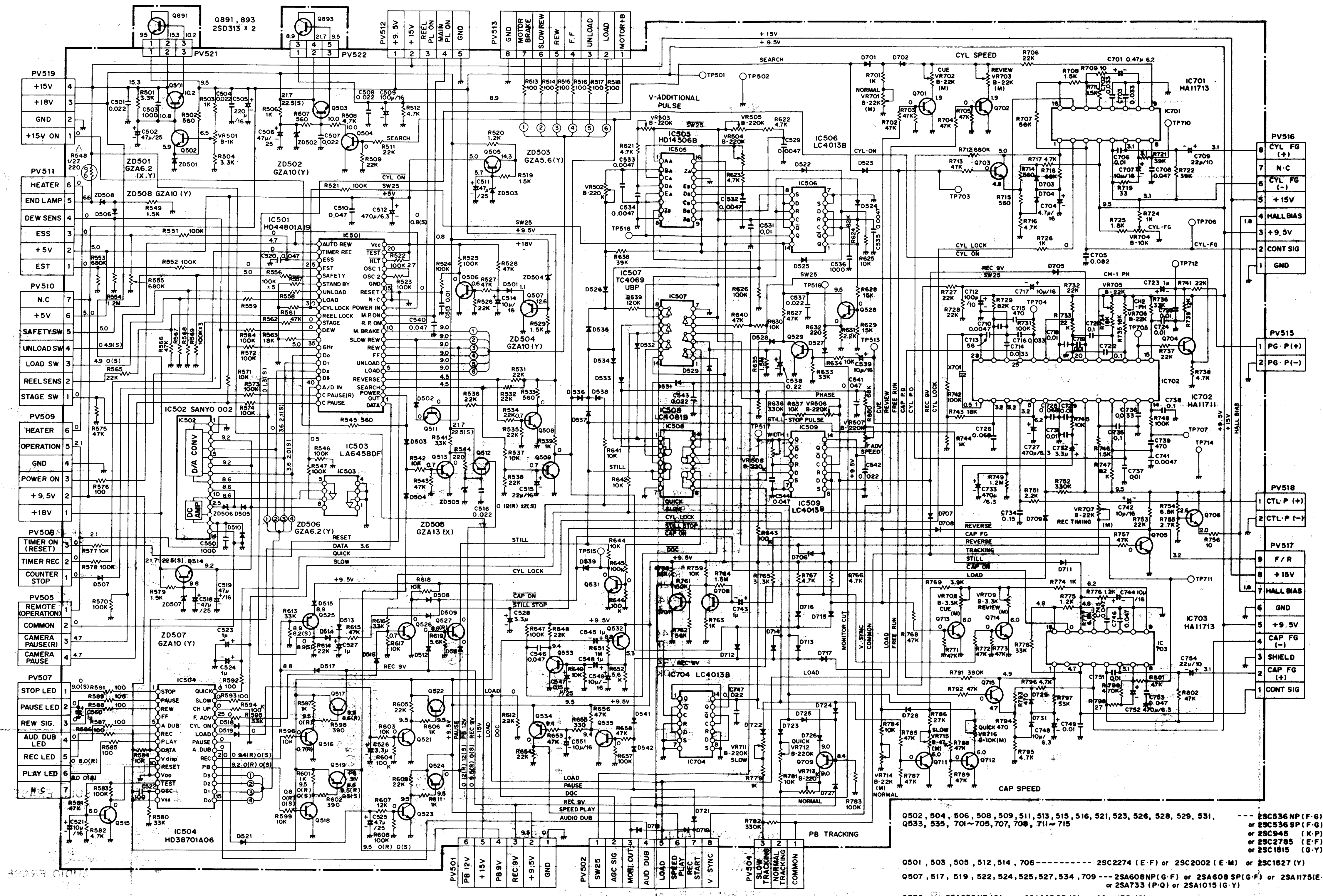
All voltage are in PLAY mode unless otherwise noted.

( ) : RECORD mode

NOTES:

1. All resistance values in "OHMS" unless otherwise noted (K=1,000 M=1,000,000)
2. All inductance values in "mH" unless otherwise noted. μ=micro Henry.

SYSTEM CONTROL SERVO DIAGRAM


Q891, 893
2SD313 x 2
PV521
PV522
PV512
+9.5V
+15V
REEL PL ON
MAIN PL ON
GND
PV513
GND
MOTOR BRAKE
SLOW REW
REW
F.F
UNLOAD
LOAD
MOTOR+B
PV519
+15V
+18V
GND
+15V ON
PV511
HEATER
END LAMP
DEW SENS
ESS
+5V
EST
PV510
N.C
+5V
SAFETY SW
UNLOAD SW
LOAD SW
REEL SENS
STAGE SW
PV509
HEATER
OPERATION
GND
POWER ON
+9.5V
+18V
PV508
TIMER ON (RESET)
TIMER REC
COUNTER STOP
PV505
REMOTE (OPERATION)
COMMON
CAMERA PAUSE(R)
CAMERA PAUSE
PV507
STOP LED
PAUSE LED
REW SIG.
AUD. DUB LED
REC LED
PLAY LED
N.C
IC501
HD44801A19
IC502 SANYO 002
D/A CONV
DC AMP
IC503
LA6458DF
IC504
HD38701A06
IC505
HD14506B
IC506
LC4013B
IC507
TC4069
UBP
IC508
LC4081B
IC509
LC4013B
IC701
HA11713
IC702
HA11711
IC703
HA11713
IC704
LC4013B
V-ADDITIONAL PULSE
CYL SPEED
CAP SPEED
PB TRACKING
PV516
CYL FG (+)
N.C
CYL FG (−)
+15V
HALL BIAS
+9.5V
CONT SIG
GND
PV515
PG·P(+)
PG·P(−)
PV518
CTL·P (+)
CTL·P (−)
PV517
F/R
+15V
HALL BIAS
GND
+9.5V
CAP FG (−)
SHIELD
CAP FG (+)
CONT SIG
PV501
PB 12V
+15V
PB 9V
REC 9V
+9.5V
GND
PV502
SW25
AGC SIG
MONI. CUT
AUD DUB
LOAD
SPEED PLAY
REC START
V. SYNC
PV504
SLOW TRACKING
NORMAL TRACKING
COMMON

Q502, 504, 506, 508, 509, 511, 513, 515, 516, 521, 523, 526, 528, 529, 531, Q533, 535, 701～705, 707, 708, 711～715 --- 2SC536 NP (F·G) or 2SC536 SP (F·G) or 2SC945 (K·P) or 2SC2785 (E·F) or 2SC1815 (G·Y)

Q501, 503, 505, 512, 514, 706 ---------- 2SC2274 (E·F) or 2SC2002 (E·M) or 2SC1627 (Y)

Q507, 517, 519, 522, 524, 525, 527, 534, 709 --- 2SA608NP (G·F) or 2SA608 SP (G·F) or 2SA1175 (E·F) or 2SA733 (P·Q) or 2SA1015 (G·Y)

Q532 --- 2SA608 NP (G) or 2SA608 SP (G) or 2SA 1175 (E)

Q518 --- DT6124N

ALL DIODES IS DS442 or 1S2076

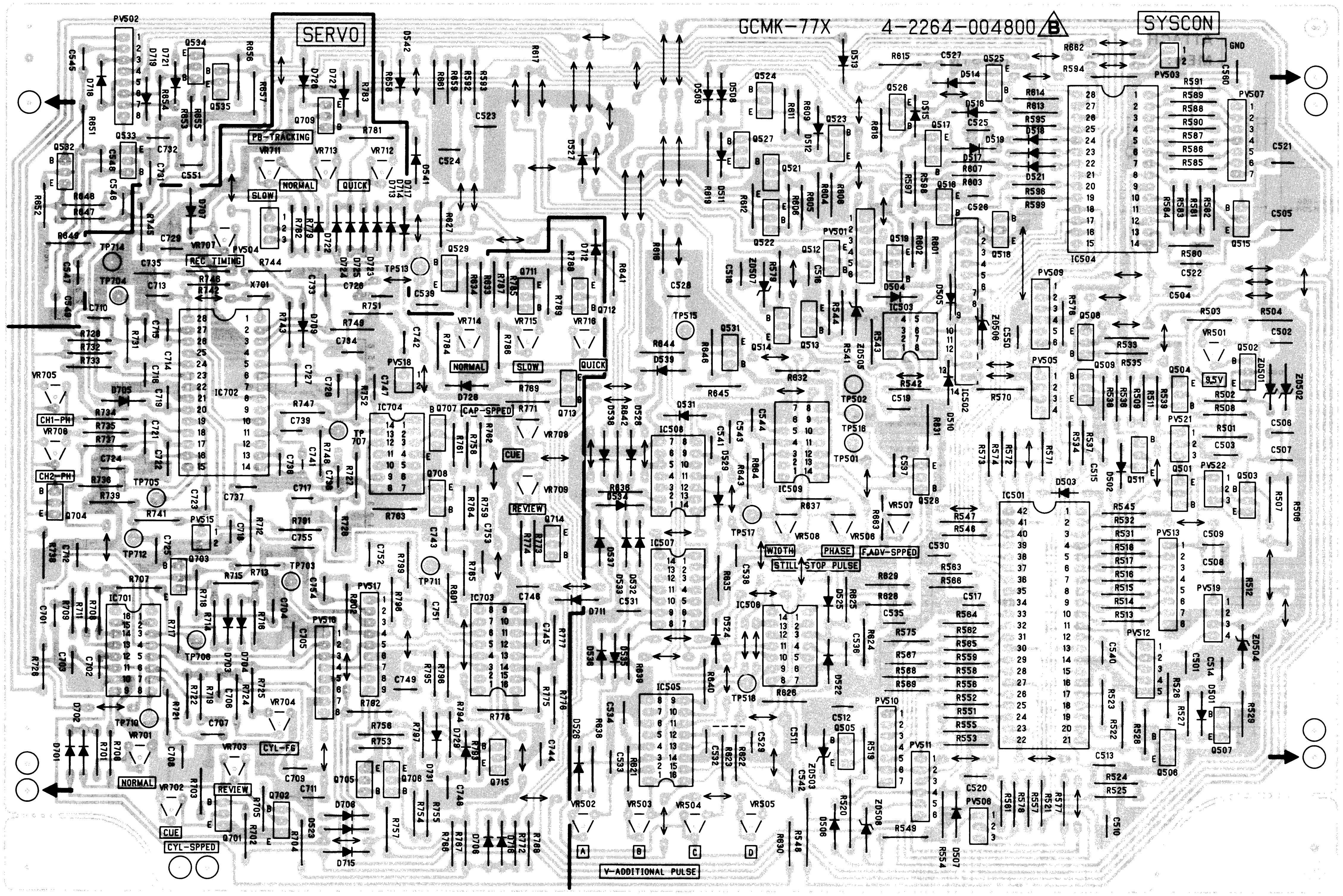
PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A UNIT. COMPONENTS INDICATED BY THE SYMBOL ⚠ IN THIS SCHEMATIC DIAGRAM SHOW COMPONENTS WHOSE VALUE HAVE SPECIAL SIGNIFICANCE TO PRODUCT SAFETY. IT IS PARTICULARLY RECOMMENDED THAT ONLY PARTS SPECIFIED ON THE ATTACHED PARTS LIST BE USED FOR COMPONENT REPLACEMENT DESIGNATED BY THE SYMBOL.

NOTES:
All voltage are in PLAY, RECORD and STOP mode unless otherwise noted.
(R) = RECORD mode only
(S) = STOP Mode only

NOTES:
1. All resistance values in "OHMS" unless otherwise noted. (K=1,000 M=1,000,000)
2. All inductance values in "mH" unless otherwise noted. µ=micro henry.

SYSTEM CONTROL SERVO P.C.B.



SERVO
GCMK-77X
4-2264-004800 B
SYSCON
GND
PB-TRACKING
NORMAL
QUICK
SLOW
REC TIMING
CAP-SPPED
CUE
REVIEW
CH1-PH
CH2-PH
CYL-FG
CYL-SPPED
WIDTH
PHASE
F.ADV-SPPED
STILL
STOP PULSE
V-ADDITIONAL PULSE
9.5V
IC501
IC502
IC503
IC504
IC505
IC506
IC507
IC508
IC509
IC701
IC702
IC703
IC704

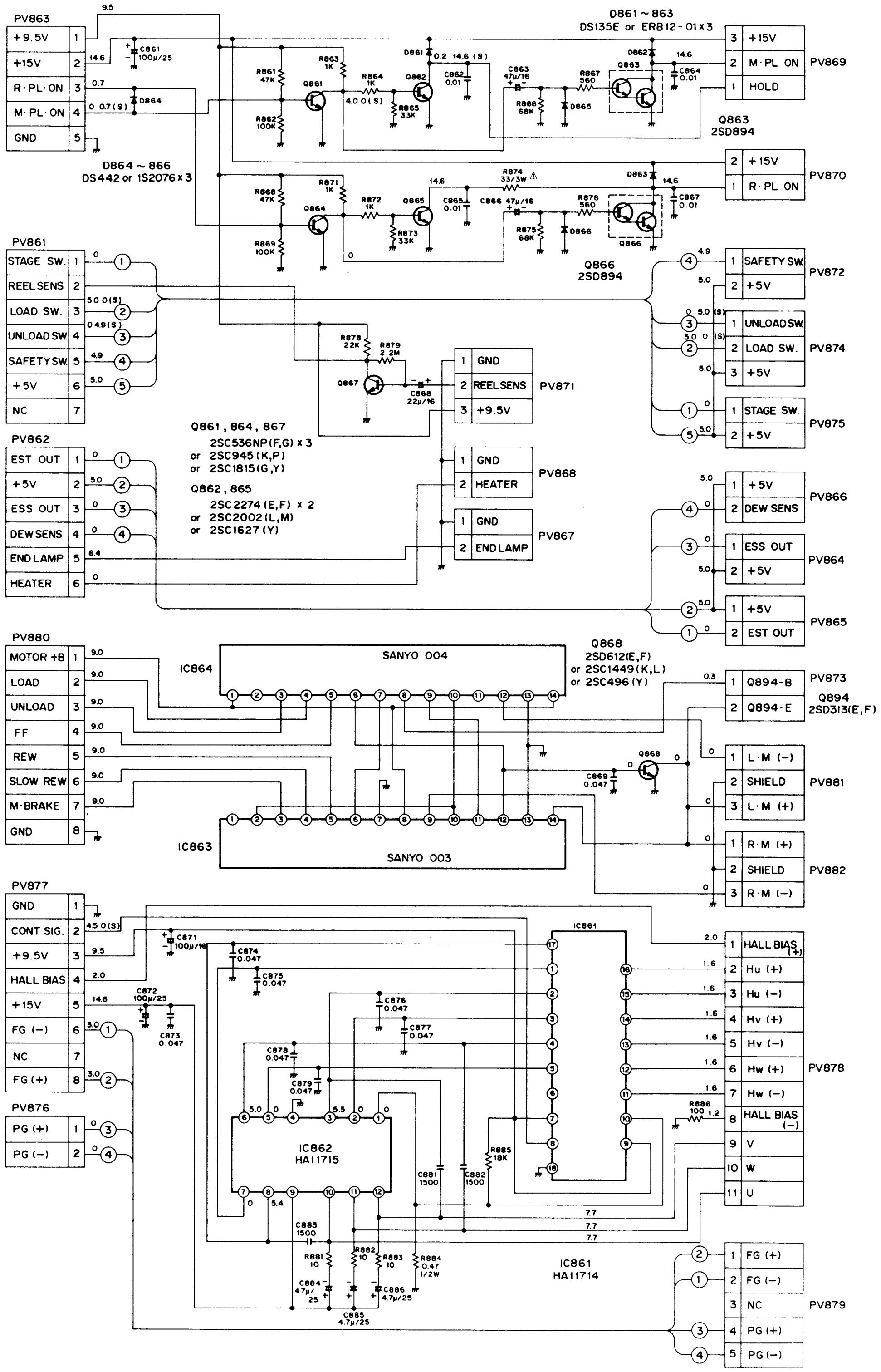
SYSTEM CONTROL DRIVE DIAGRAM

NOTES:
All voltage are in PLAY, RECORD and STOP mode unless otherwise noted.
(S) = STOP mode only

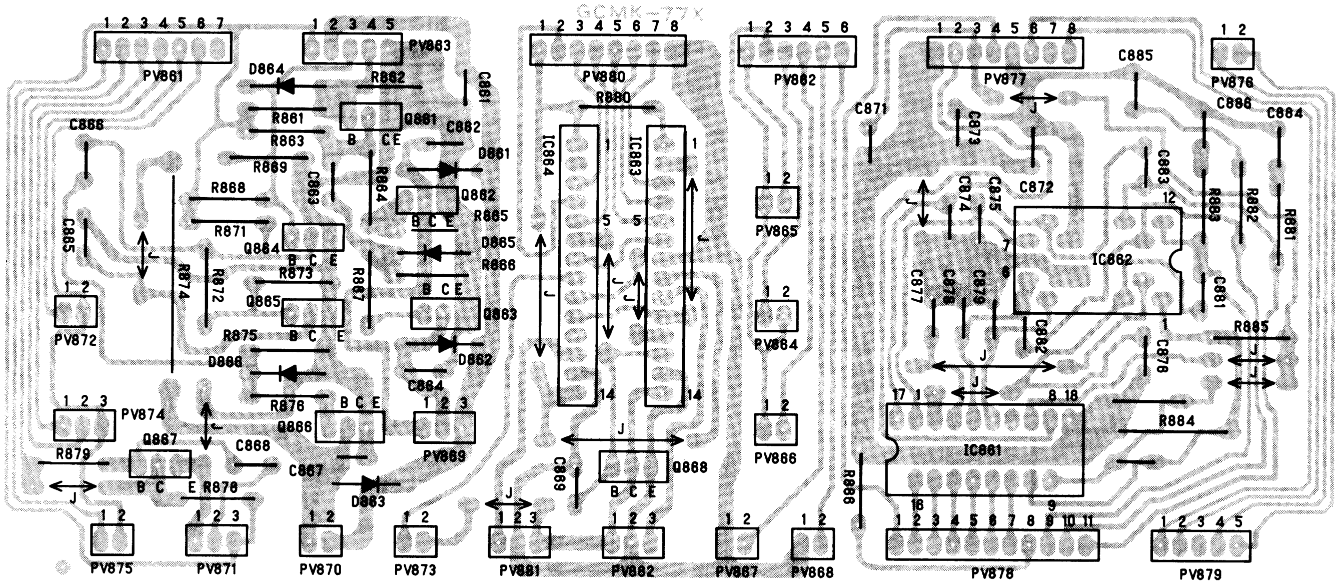
NOTES:
1. All resistance values in "OHMS"unless otherwise noted.(K=1,000 M=1,000,000)
2. All inductance values in "mH"unless otherwise noted.μ=micro henry.

PRODUCT SAFETY NOTICE

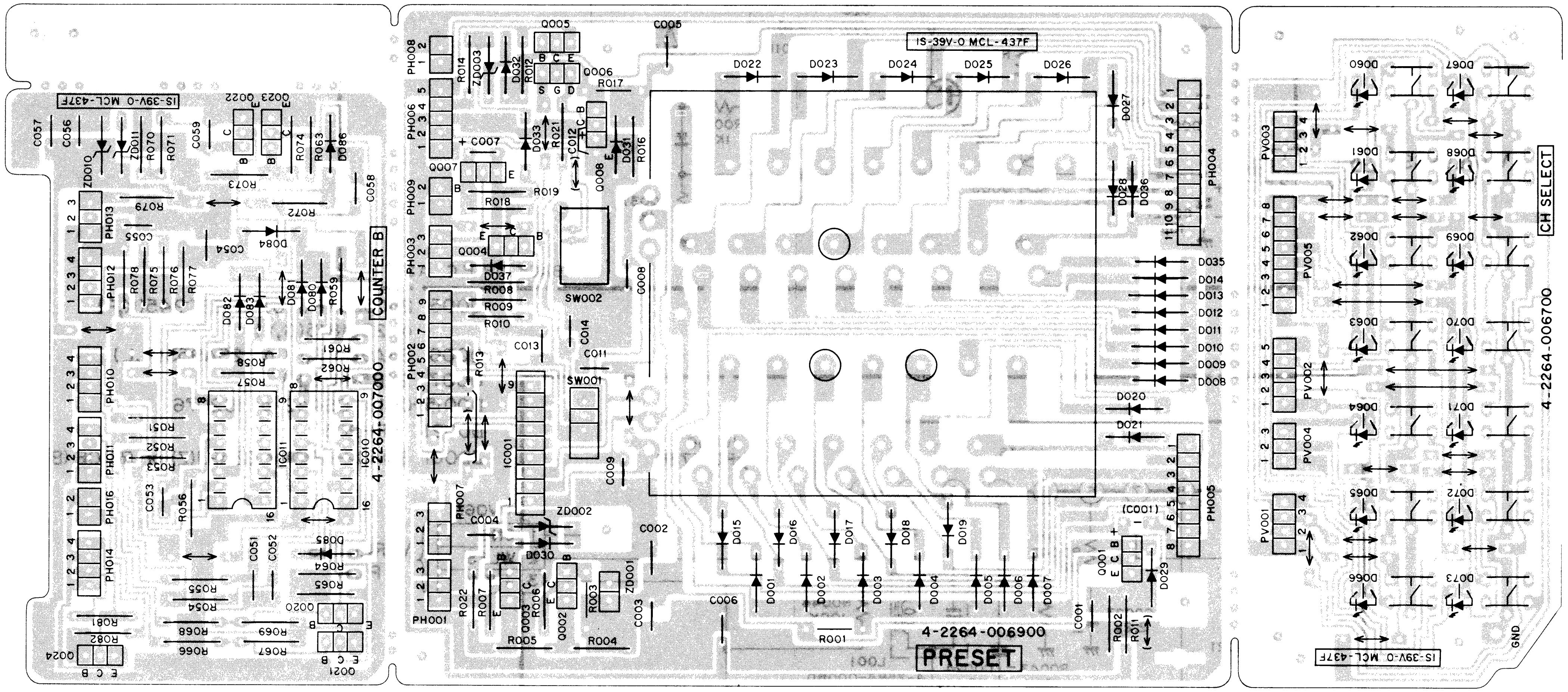
PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A UNIT. COMPONENTS INDICATED BY THE SYMBOL ⚠ IN THIS SCHEMATIC DIAGRAM SHOW COMPONENTS WHOSE VALUE HAVE SPECIAL SIGNIFICANCE TO PRODUCT SAFETY. IT IS PARTICULARLY RECOMMENDED THAT ONLY PARTS SPECIFIED ON THE ATTACHED PARTS LIST BE USED FOR COMPONENT REPLACEMENT DESIGNATED BY THE SYMBOL.


PV863
+9.5V
+15V
R·PL·ON
M·PL·ON
GND
D861 ~ 863
DS135E or ERB12-01x3
D864 ~ 866
DS442 or 1S2076x3
Q861
Q862
Q863
2SD894
Q864
Q865
Q866
2SD894
Q867
PV869
M·PL ON
HOLD
PV870
R·PL ON
R874 33/3W ⚠
PV861
STAGE SW.
REEL SENS
LOAD SW.
UNLOAD SW.
SAFETY SW.
+5V
NC
PV871
GND
REEL SENS
+9.5V
Q861, 864, 867
2SC536NP(F,G) x 3
or 2SC945(K,P)
or 2SC1815(G,Y)
Q862, 865
2SC2274(E,F) x 2
or 2SC2002(L,M)
or 2SC1627(Y)
PV862
EST OUT
ESS OUT
DEW SENS
END LAMP
HEATER
PV868
PV867
PV872
PV874
PV875
PV866
PV864
PV865
PV880
MOTOR +B
LOAD
UNLOAD
FF
REW
SLOW REW
M·BRAKE
IC864
SANYO 004
IC863
SANYO 003
Q868
2SD612(E,F)
or 2SC1449(K,L)
or 2SC496(Y)
PV873
Q894-B
Q894-E
Q894
2SD313(E,F)
PV881
L·M (−)
SHIELD
L·M (+)
PV882
R·M (+)
R·M (−)
PV877
CONT SIG.
HALL BIAS
FG (−)
FG (+)
PV876
PG (+)
PG (−)
IC861
HA11714
IC862
HA11715
PV878
HALL BIAS (+)
Hu (+)
Hu (−)
Hv (+)
Hv (−)
Hw (+)
Hw (−)
HALL BIAS (−)
V
W
U
PV879

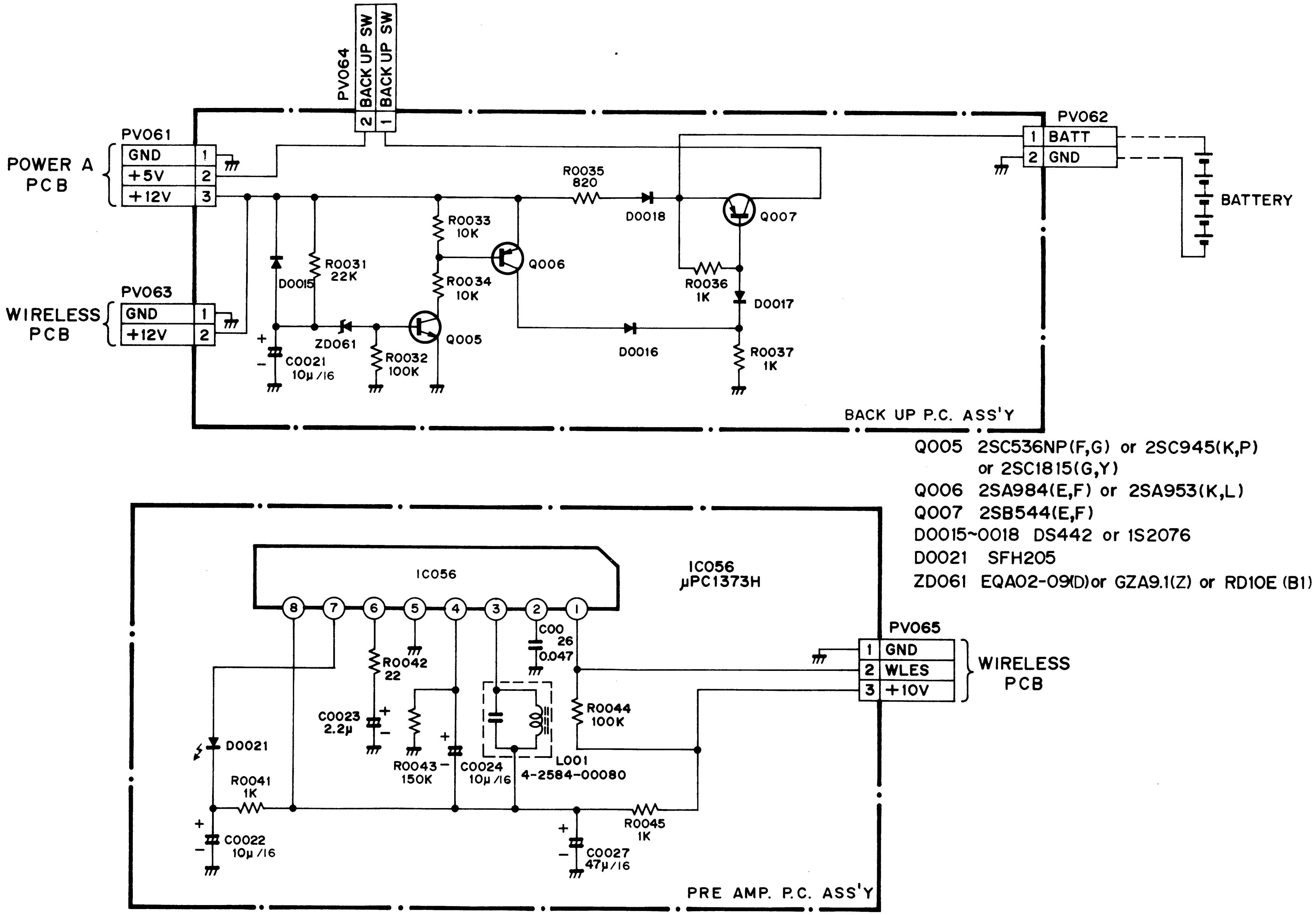
SYSTEM CONTROL DRIVE P.C.B.


GCMK-77X
PV861
PV863
PV880
PV882
PV877
PV876
D864
R862
C861
R861
Q881
C862
R863
D861
R869
C863
R864
R868
Q862
R865
R871
Q864
D865
R866
R874
R872
R873
R867
Q865
Q863
R875
D866
D862
C864
R876
Q866
C866
C865
PV872
PV874
Q867
C868
R879
C867
R878
D863
PV869
PV875
PV871
PV870
PV873
PV881
PV882
PV867
PV868
R880
IC864
IC863
C869
Q868
PV865
PV864
PV866
C871
C873
C872
C874
C875
C885
C886
C884
C883
R883
R882
R881
IC862
C877
C878
C879
C882
C881
R885
C876
IC861
R884
R888
PV878
PV879
J
B C E

CHANNEL SELECT PRESET AND COUNTER P.C.B.

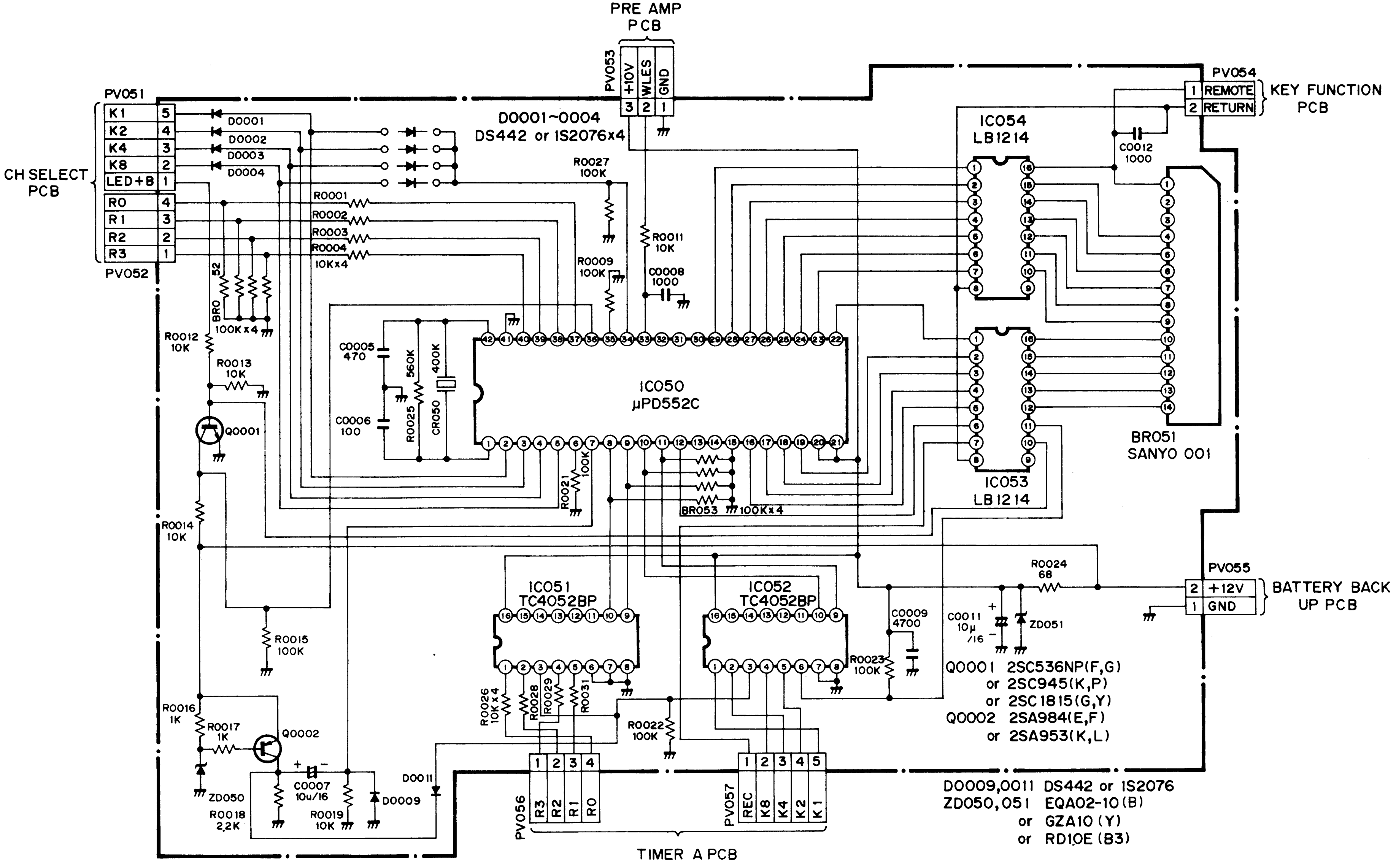

COUNTER B
4-2264-007000
IS-39V-0 MCL-437F
PRESET
4-2264-006900
IS-39V-0 MCL-437F
CH SELECT
4-2264-006700
IS-39V-0 MCL-437F
GND
PH001
PH002
PH003
PH004
PH005
PH006
PH007
PH008
PH009
PH010
PH011
PH012
PH013
PH014
PH016
PV001
PV002
PV003
PV004
PV005
IC001
IC010
IC011
SW001
SW002
Q001
Q002
Q003
Q004
Q005
Q006
Q007
Q008
Q020
Q021
Q022
Q023
Q024
ZD001
ZD002
ZD003
ZD010
ZD011
C001
C002
C003
C004
C005
C006
C007
C008
C009
C011
C012
C013
C014
C051
C052
C053
C054
C055
C056
C057
C058
C059
R001
R002
R003
R004
R005
R006
R007
R008
R009
R010
R011
R012
R013
R014
R016
R017
R018
R019
R021
R022
R051
R052
R053
R054
R055
R056
R057
R058
R059
R061
R062
R063
R064
R065
R066
R067
R068
R069
R070
R071
R072
R073
R074
R075
R076
R077
R078
R079
R081
R082
D001
D002
D003
D004
D005
D006
D007
D008
D009
D010
D011
D012
D013
D014
D015
D016
D017
D018
D019
D020
D021
D022
D023
D024
D025
D026
D027
D028
D029
D030
D031
D032
D033
D035
D036
D037
D060
D061
D062
D063
D064
D065
D066
D067
D068
D069
D070
D071
D072
D073
D080
D081
D082
D083
D084
D085
D086
E C B
B C E
S G D

BACK UP AND PRE AMP DIAGRAM

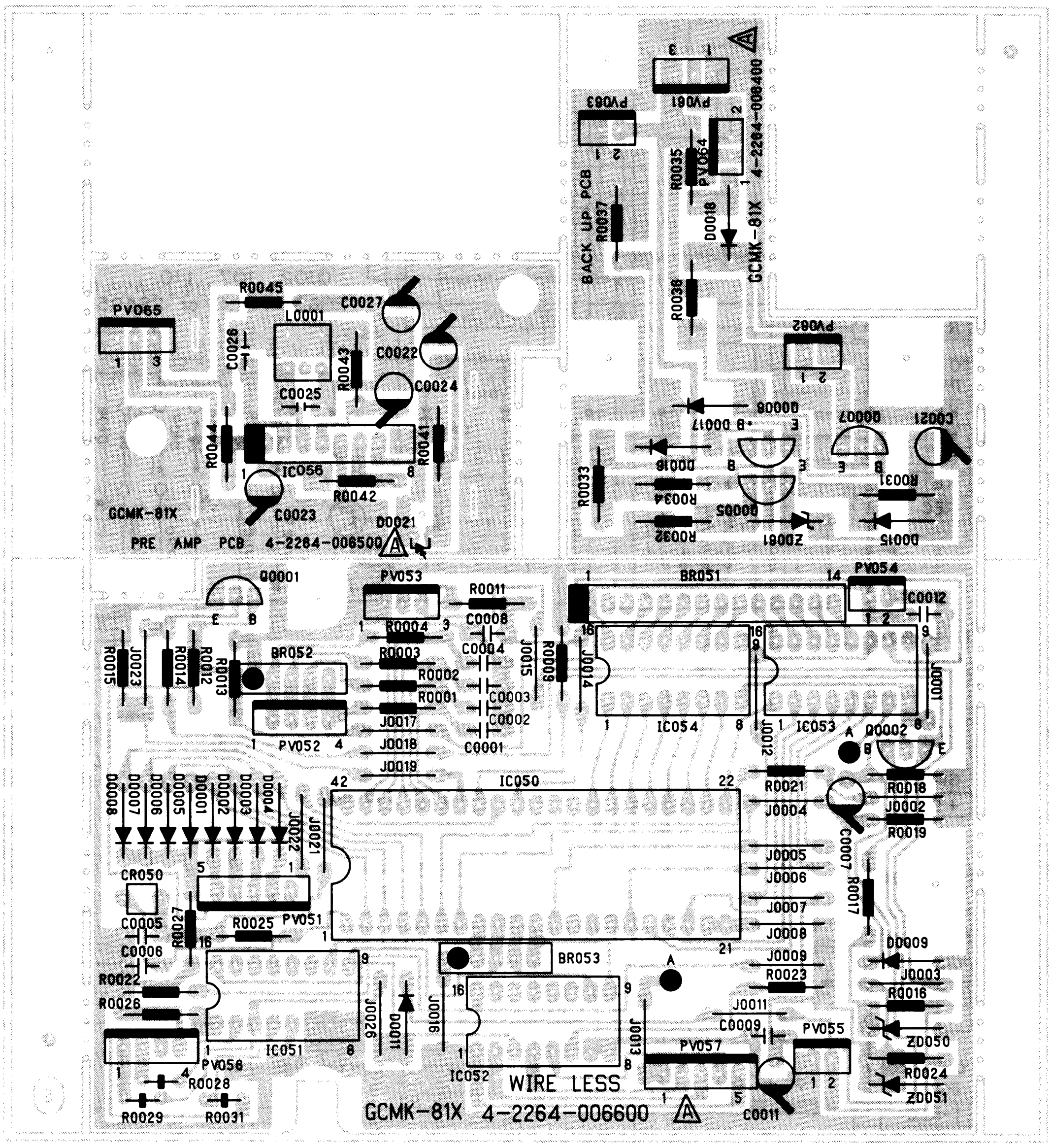

PV064
2 BACK UP SW
1 BACK UP SW
PV061
POWER A PCB
1 GND
2 +5V
3 +12V
PV063
WIRELESS PCB
1 GND
2 +12V
PV062
1 BATT
2 GND
BATTERY
R0035 820
D0018
Q007
R0033 10K
Q006
R0031 22K
D0015
R0034 10K
R0036 1K
D0017
ZD061
Q005
D0016
R0037 1K
C0021 10µ/16
R0032 100K
BACK UP P.C. ASS'Y
IC056
IC056 µPC1373H
8
7
6
5
4
3
2
1
C0026 0.047
R0042 22
PV065
1 GND
2 WLES
3 +10V
WIRELESS PCB
C0023 2.2µ
R0044 100K
D0021
R0043 150K
C0024 10µ/16
L001 4-2584-00080
R0041 1K
R0045 1K
C0022 10µ/16
C0027 47µ/16
PRE AMP. P.C. ASS'Y

Q005 2SC536NP(F,G) or 2SC945(K,P)
or 2SC1815(G,Y)
Q006 2SA984(E,F) or 2SA953(K,L)
Q007 2SB544(E,F)
D0015~0018 DS442 or 1S2076
D0021 SFH205
ZD061 EQA02-09(D)or GZA9.1(Z) or RD10E (B1)

WIRELESS DIAGRAM

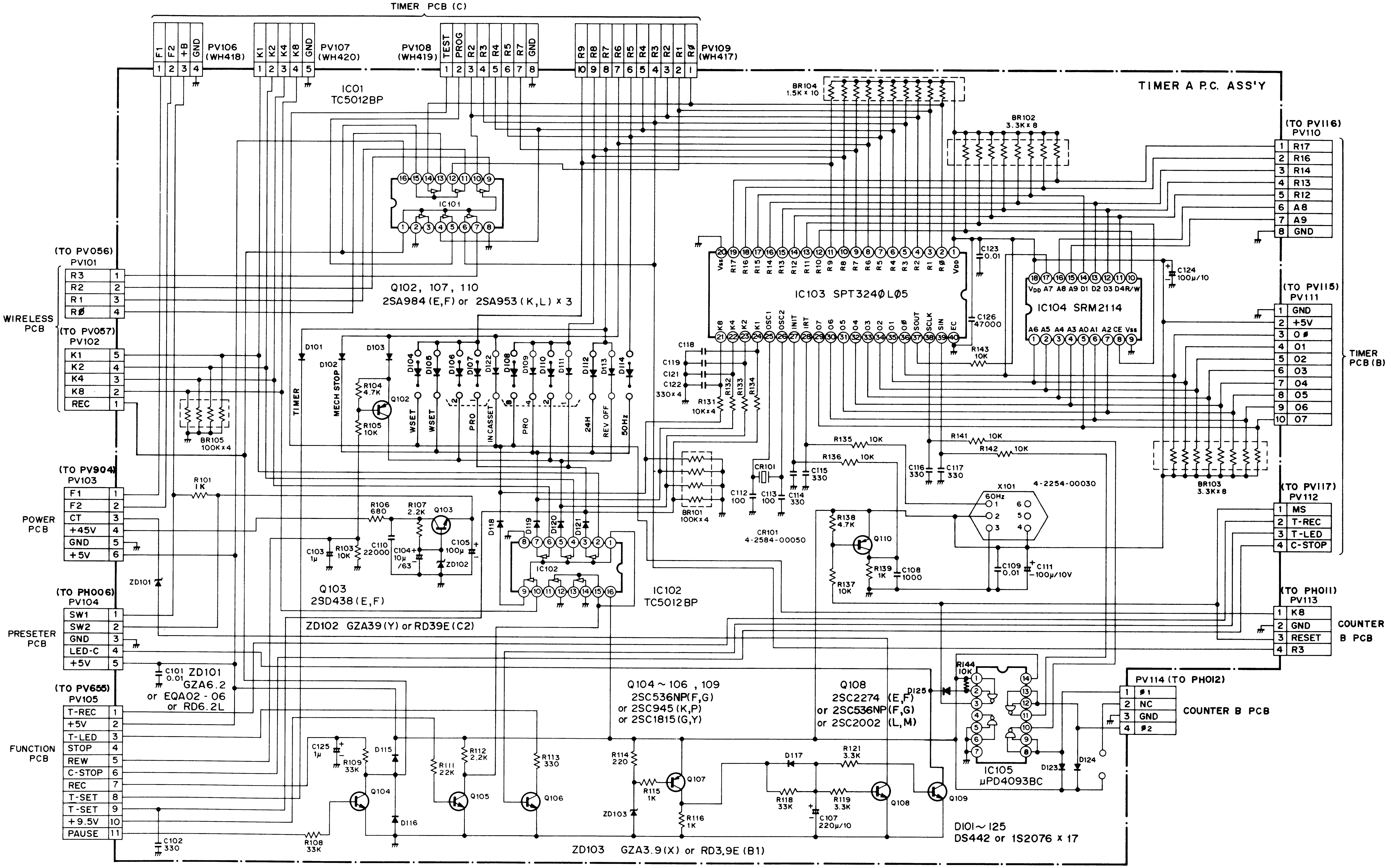

PRE AMP PCB
PV053
+10V
WLES
GND
3 2 1
PV054
1 REMOTE
2 RETURN
KEY FUNCTION PCB
CH SELECT PCB
PV051
K1 5
K2 4
K4 3
K8 2
LED+B 1
R0 4
R1 3
R2 2
R3 1
PV052
D0001
D0002
D0003
D0004
D0001~0004
DS442 or 1S2076x4
R0001
R0002
R0003
R0004
10Kx4
R0027 100K
R0009 100K
R0011 10K
C0008 1000
C0012 1000
BR052
100Kx4
R0012 10K
R0013 10K
Q0001
C0005 470
C0006 100
560K
R0025
400K
CR050
IC050
μPD552C
R0021 100K
BR053 100Kx4
IC054
LB1214
IC053
LB1214
BR051
SANYO 001
R0014 10K
R0015 100K
R0016 1K
R0017 1K
Q0002
ZD050
R0018 2.2K
C0007 10u/16
R0019 10K
D0009
D0011
IC051
TC4052BP
IC052
TC4052BP
R0026 10Kx4
R0028
R0029
R0031
R0022 100K
R0023 100K
C0009 4700
C0011 10μ /16
ZD051
R0024 68
PV055
2 +12V
1 GND
BATTERY BACK UP PCB
PV056
1 2 3 4
R3 R2 R1 R0
PV057
1 2 3 4 5
REC K8 K4 K2 K1
TIMER A PCB
Q0001 2SC536NP(F,G)
or 2SC945(K,P)
or 2SC1815(G,Y)
Q0002 2SA984(E,F)
or 2SA953(K,L)
D0009,0011 DS442 or 1S2076
ZD050,051 EQA02-10(B)
or GZA10(Y)
or RD10E(B3)

BACK UP AND PRE AMP AND WIRELESS P.C.B.

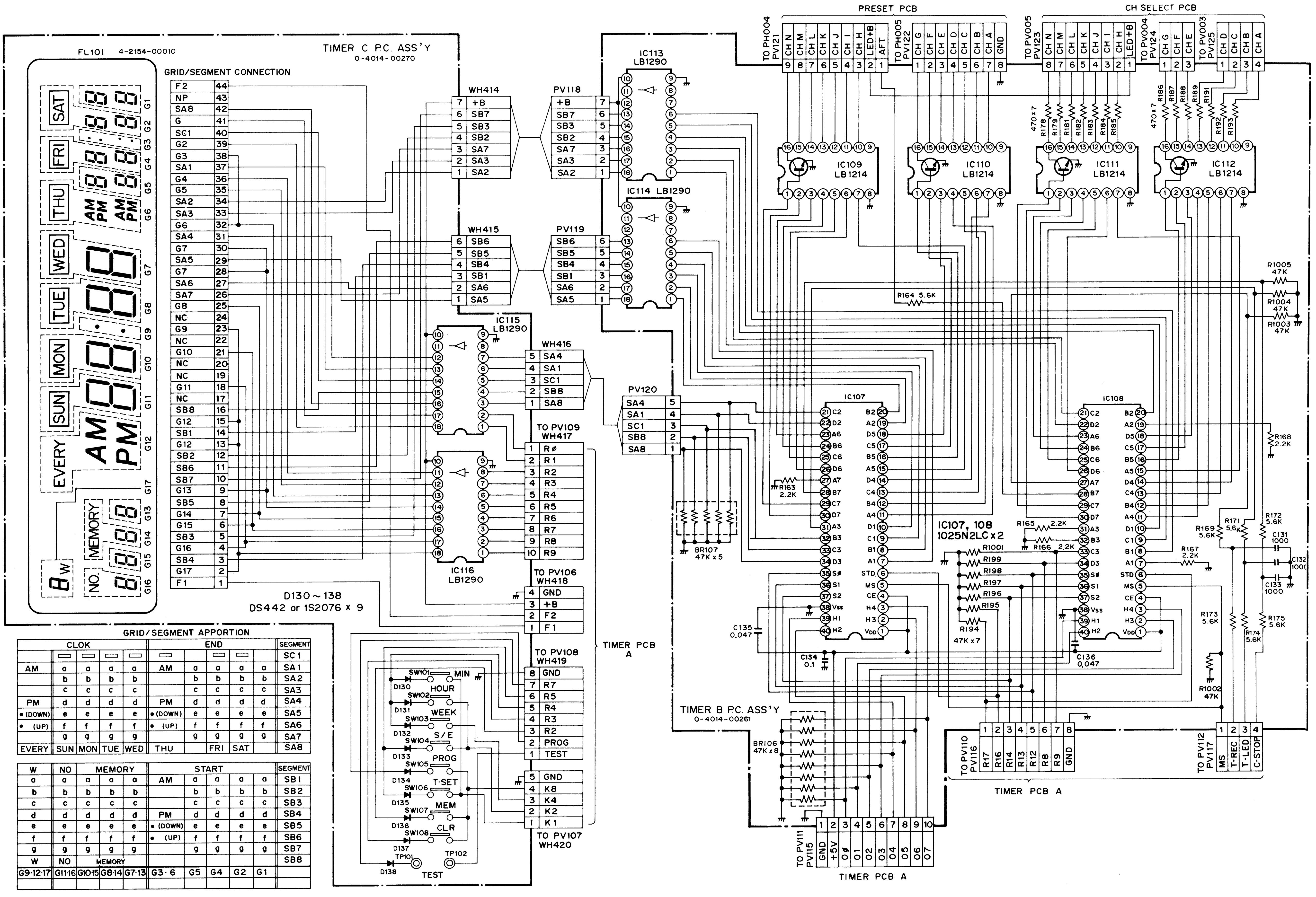

BACK UP PCB
GCMK-81X 4-2264-006400
PV061
PV063
PV064
PV062
R0035
R0037
R0036
D0018
D0017
Q0006
D0016
Q0007
C0021
R0033
R0034
R0031
Q0005
R0032
ZD061
D0015
PV065
R0045
L0001
C0027
C0026
C0022
R0043
C0025
C0024
R0044
IC056
R0041
R0042
C0023
D0021
GCMK-81X
PRE AMP PCB 4-2264-006500
Q0001
PV053
R0011
C0008
R0004
C0004
R0003
R0002
R0001
C0003
C0002
C0001
J0015
R0009
J0014
BR051
PV054
C0012
BR052
PV052
R0015
J0023
R0014
R0012
R0013
J0017
J0018
J0019
IC054
IC053
J0012
J0001
Q0002
R0021
R0018
J0004
J0002
R0019
C0007
R0017
IC050
D0008
D0007
D0006
D0005
D0001
D0002
D0003
D0004
J0022
J0021
CR050
C0005
C0006
R0027
R0025
PV051
J0005
J0006
J0007
J0008
J0009
R0023
BR053
D0009
J0003
R0016
ZD050
R0024
ZD051
R0022
R0026
IC051
J0026
D0011
J0016
IC052
J0013
J0011
C0009
PV055
PV057
C0011
PV056
R0028
R0029
R0031
WIRE LESS
GCMK-81X 4-2264-006600

Ⓟ

TIMER A DIAGRAM


TIMER PCB (C)
F1 F2 +B GND PV106 (WH418)
K1 K2 K4 K8 GND PV107 (WH420)
PV108 (WH419) TEST PROG R2 R3 R4 R5 R7 GND
R9 R8 R7 R6 R5 R4 R3 R2 R1 RØ PV109 (WH417)
TIMER A P.C. ASS'Y
IC01 TC5012BP
IC101
BR104 1.5K x 10
BR102 3.3K x 8
(TO PV116) PV110
R17 R16 R14 R13 R12 A8 A9 GND
IC103 SPT324ØLØ5
IC104 SRM2114
C123 0.01
C124 100μ/10
C126 47000
(TO PV115) PV111
GND +5V OØ O1 O2 O3 O4 O5 O6 O7
TIMER PCB (B)
(TO PV056) PV101
R3 R2 R1 RØ
WIRELESS PCB
(TO PV057) PV102
K1 K2 K4 K8 REC
Q102, 107, 110
2SA984 (E,F) or 2SA953 (K,L) x 3
BR105 100K x 4
D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113 D114
TIMER
MECH STOP
R104 4.7K
R105 10K
Q102
WSET WSET PRO IN CASSET PRO 24H REV OFF 50Hz
C118 C119 C121 C122 330 x 4
R131 10K x 4 R132 R133 R134
R143 10K
R135 10K
R136 10K
R141 10K
R142 10K
BR103 3.3K x 8
(TO PV117) PV112
MS T-REC T-LED C-STOP
(TO PV904) PV103
F1 F2 CT +45V GND +5V
POWER PCB
R101 1K
R106 680
R107 2.2K
Q103
C103 1μ
R103 10K
C110 22000
C104 10μ /63
C105 100μ
ZD102
Q103 2SD438 (E,F)
ZD102 GZA39 (Y) or RD39E (C2)
D118 D119 D120 D121
IC102
IC102 TC5012BP
BR101 100K x 4
CR101
C112 100
C113 100
C114 330
C115 330
CR101 4-2584-00050
C116 330
C117 330
X101 4-2254-00030
60Hz
R138 4.7K
Q110
R139 1K
C108 1000
R137 10K
C109 0.01
C111 100μ/10V
ZD101
(TO PH006) PV104
SW1 SW2 GND LED-C +5V
PRESETER PCB
(TO PH011) PV113
K8 GND RESET R3
COUNTER B PCB
C101 0.01
ZD101 GZA6.2 or EQA02-06 or RD6.2L
(TO PV655) PV105
T-REC +5V T-LED STOP REW C-STOP REC T-SET T-SET +9.5V PAUSE
FUNCTION PCB
Q104~106, 109
2SC536NP(F,G) or 2SC945 (K,P) or 2SC1815 (G,Y)
Q108
2SC2274 (E,F) or 2SC536NP (F,G) or 2SC2002 (L,M)
R144 10K
D125
PV114 (TO PH012)
Ø1 NC GND Ø2
COUNTER B PCB
C125 1μ
R109 33K
D115
D116
Q104
R111 22K
R112 2.2K
Q105
R113 330
Q106
R114 220
R115 1K
Q107
ZD103
R116 1K
D117
R121 3.3K
R118 33K
R119 3.3K
C107 220μ/10
Q108
Q109
IC105 μPD4093BC
D123 D124
D101~125
DS442 or 1S2076 x 17
C102 330
R108 33K
ZD103 GZA3.9 (X) or RD3.9E (B1)

TIMER B.C. DIAGRAM


TIMER C P.C. ASS'Y
0-4014-00270
FL101 4-2154-00010
SAT
FRI
THU
WED
TUE
MON
SUN
EVERY
AM
PM
MEMORY
NO.
W
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10
G11
G12
G17
G13
G14
G15
G16
GRID/SEGMENT CONNECTION
WH414
+B
SB7
SB3
SB2
SA7
SA3
SA2
PV118
WH415
SB6
SB5
SB4
SB1
SA6
SA5
PV119
IC113
LB1290
IC114 LB1290
IC115
LB1290
IC116
LB1290
WH416
SA4
SA1
SC1
SB8
SA8
PV120
TO PV109
WH417
R∅
R1
R2
R3
R4
R5
R6
R7
R8
R9
TO PV106
WH418
GND
+B
F2
F1
TIMER PCB
A
D130 ~ 138
DS442 or 1S2076 x 9
TO PV108
WH419
GND
R7
R5
R4
R3
R2
PROG
TEST
SW101
MIN
D130
SW102
HOUR
D131
SW103
WEEK
D132
S/E
SW104
D133
PROG
SW105
D134
T·SET
SW106
D135
MEM
SW107
D136
CLR
SW108
D137
TP101
TP102
D138
TEST
GND
K8
K4
K2
K1
TO PV107
WH420
PRESET PCB
TO PH004
PV121
CH N
CH M
CH L
CH K
CH J
CH I
CH H
LED+B
AFT
TO PH005
PV122
CH G
CH F
CH E
CH D
CH C
CH B
CH A
GND
CH SELECT PCB
TO PV005
PV123
TO PV004
PV124
TO PV003
PV125
470 x 7
R178
R179
R181
R182
R183
R184
R185
R186
R187
R188
R189
R191
R192
R193
IC109
LB1214
IC110
LB1214
IC111
LB1214
IC112
LB1214
R164 5.6K
R1005
47K
R1004
47K
R1003
47K
IC107
IC108
C2
D2
A6
B6
C6
D6
A7
B7
C7
D7
A3
B3
C3
D3
S∅
S1
S2
Vss
H1
H2
B2
A2
D5
C5
B5
A5
D4
C4
B4
A4
D1
C1
B1
A1
STD
MS
CE
H4
H3
VDD
R163
2.2K
IC107, 108
1025N2LC x 2
R165 2.2K
R166 2.2K
R1001
R199
R198
R197
R196
R195
R194
47K x 7
BR107
47K x 5
C135
0.047
C134
0.1
C136
0.047
R168
2.2K
R169
5.6K
R171
5.6K
R172
5.6K
C131
1000
C132
1000
C133
1000
R167
2.2K
R173
5.6K
R174
5.6K
R175
5.6K
R1002
47K
TIMER B P.C. ASS'Y
0-4014-00261
BR106
47K x 8
TO PV110
PV116
R17
R16
R14
R13
R12
R8
R9
GND
TIMER PCB A
TO PV112
PV117
MS
T-REC
T-LED
C-STOP
TO PV111
PV115
GND
+5V
0∅
01
02
03
04
05
06
07
TIMER PCB A

GRID/SEGMENT CONNECTION

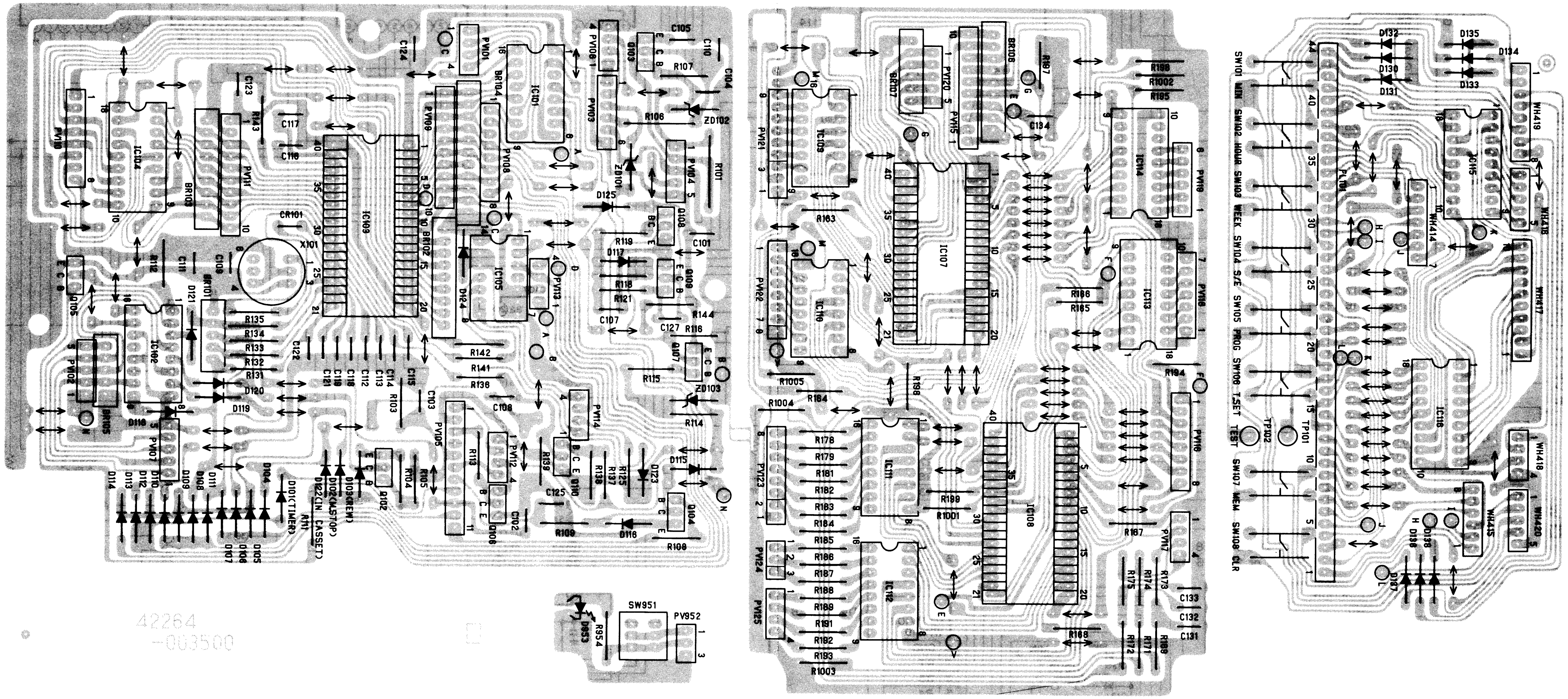
F2	44
NP	43
SA8	42
G	41
SC1	40
G2	39
G3	38
SA1	37
G4	36
G5	35
SA2	34
SA3	33
G6	32
SA4	31
G7	30
SA5	29
G7	28
SA6	27
SA7	26
G8	25
NC	24
G9	23
NC	22
G10	21
NC	20
NC	19
G11	18
NC	17
SB8	16
G12	15
SB1	14
G12	13
SB2	12
SB6	11
SB7	10
G13	9
SB5	8
G14	7
G15	6
SB3	5
G16	4
SB4	3
G17	2
F1	1

GRID/SEGMENT APPORTION

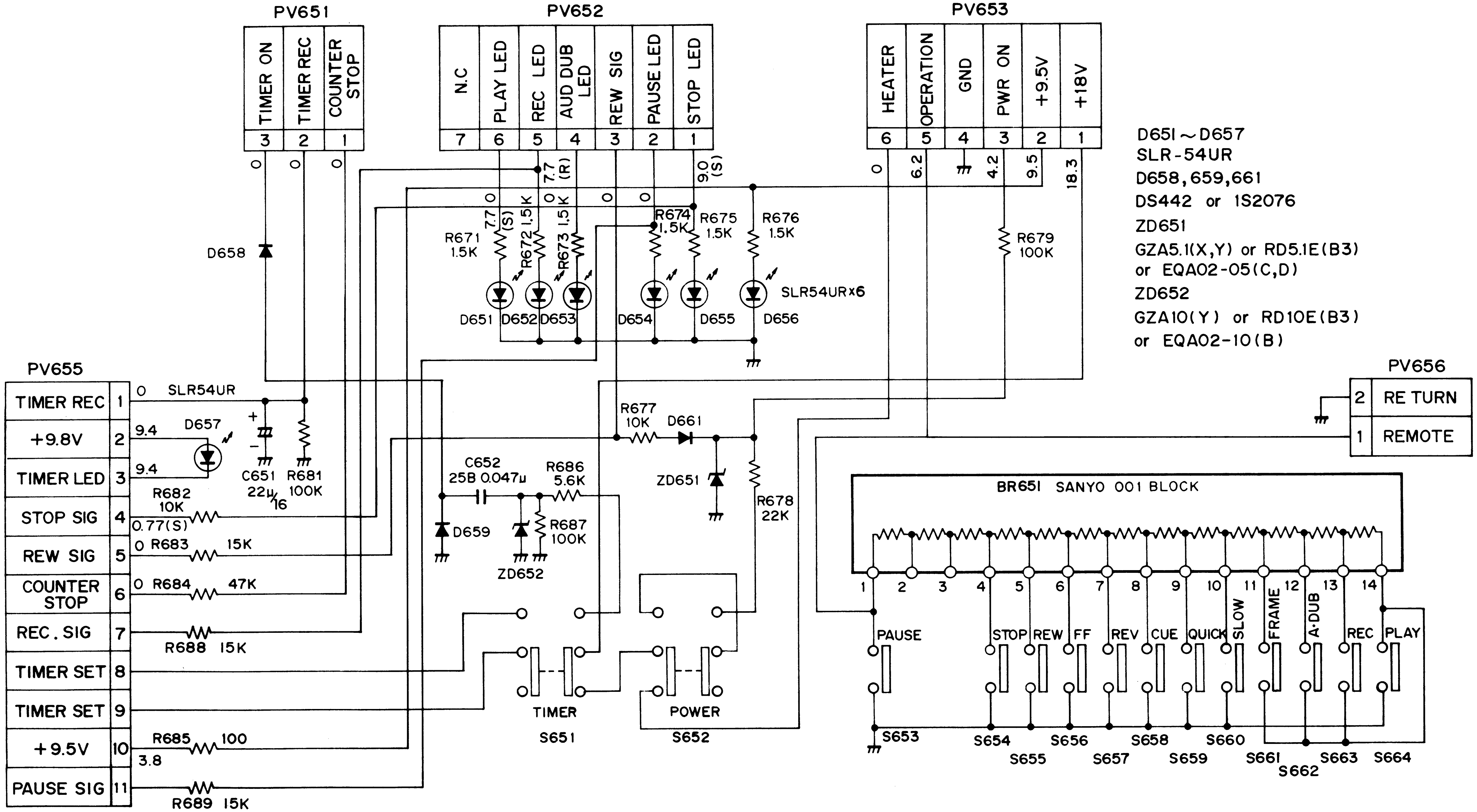
CLOK					END					SEGMENT
	▭	▭	▭	▭	▭		▭	▭		SC1
AM	a	a	a	a	AM	a	a	a	a	SA1
	b	b	b	b		b	b	b	b	SA2
	c	c	c	c		c	c	c	c	SA3
PM	d	d	d	d	PM	d	d	d	d	SA4
• (DOWN)	e	e	e	e	• (DOWN)	e	e	e	e	SA5
• (UP)	f	f	f	f	• (UP)	f	f	f	f	SA6
	g	g	g	g		g	g	g	g	SA7
EVERY	SUN	MON	TUE	WED	THU		FRI	SAT		SA8

W	NO	MEMORY			START					SEGMENT
a	a	a	a	a	AM	a	a	a	a	SB1
b	b	b	b	b		b	b	b	b	SB2
c	c	c	c	c		c	c	c	c	SB3
d	d	d	d	d	PM	d	d	d	d	SB4
e	e	e	e	e	• (DOWN)	e	e	e	e	SB5
f	f	f	f	f	• (UP)	f	f	f	f	SB6
g	g	g	g	g		g	g	g	g	SB7
W	NO	MEMORY								SB8
G9·12·17	G11·16	G10·15	G8·14	G7·13	G3 · 6	G5	G4	G2	G1	

TIMER A.B.C. P.C.B.


IC101
IC102
IC103
IC104
IC105
IC107
IC108
IC109
IC110
IC111
IC112
IC113
IC114
IC115
IC116
X101
CR101
BR101
BR102
BR103
BR104
BR105
BR107
BR108
PV101
PV102
PV103
PV104
PV105
PV106
PV107
PV108
PV109
PV110
PV111
PV112
PV113
PV114
PV115
PV116
PV117
PV118
PV119
PV120
PV121
PV122
PV123
PV124
PV125
PL101
WH414
WH415
WH417
WH418
WH419
WH420
SW101 MIN
SW102 HOUR
SW103 WEEK
SW104 S/E
SW105 PROG
SW106 T.SET
TEST
SW107 MEM
SW108 CLR
TP101
TP102
ZD101
ZD102
ZD103
D101(TIMER)
D102(A.STOP)
D103(REM)
D122(IN CASSET)
Q101
Q102
Q103
Q104
Q105
Q106
Q107
Q108
Q109
Q110
SW951
PV952
D953
R954
42264
-003500

KEY FUNCTION DIAGRAM

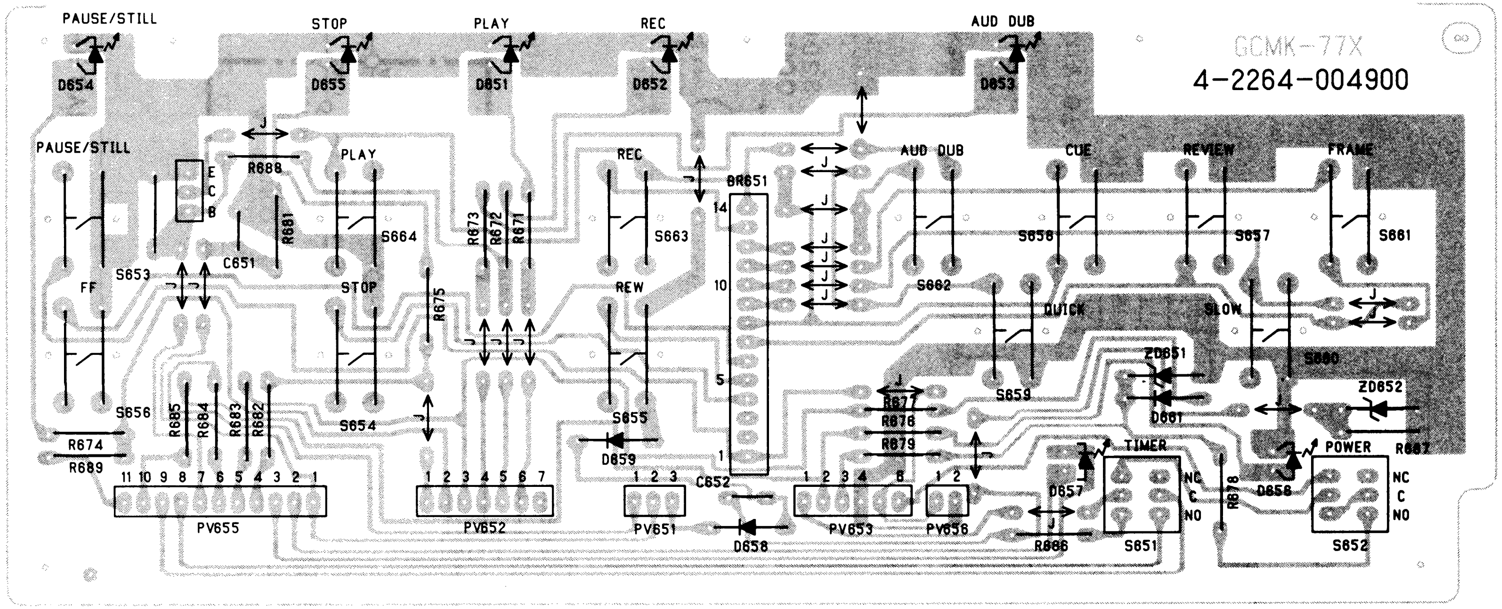

PV651
TIMER ON
TIMER REC
COUNTER STOP
3 2 1
PV652
N.C
PLAY LED
REC LED
AUD DUB LED
REW SIG
PAUSE LED
STOP LED
7 6 5 4 3 2 1
PV653
HEATER
OPERATION
GND
PWR ON
+9.5V
+18V
6 5 4 3 2 1
0
6.2
4.2
9.5
18.3
7.7
(R)
9.0
(S)
7.7
(S)
R671
1.5K
R672 1.5K
R673 1.5K
R674
1.5K
R675
1.5K
R676
1.5K
R679
100K
D658
D651
D652
D653
D654
D655
D656
SLR54URx6
PV655
TIMER REC 1
+9.8V 2
TIMER LED 3
STOP SIG 4
REW SIG 5
COUNTER STOP 6
REC.SIG 7
TIMER SET 8
TIMER SET 9
+9.5V 10
PAUSE SIG 11
SLR54UR
9.4
9.4
D657
C651
22μ 16
R681
100K
R682
10K
0.77(S)
R683 15K
R684 47K
R688 15K
R685 100
3.8
R689 15K
C652
25B 0.047μ
R686
5.6K
D659
ZD652
R687
100K
R677
10K
D661
ZD651
R678
22K
TIMER
S651
POWER
S652
PV656
2 RE TURN
1 REMOTE
BR651 SANYO 001 BLOCK
1 2 3 4 5 6 7 8 9 10 11 12 13 14
PAUSE
STOP
REW
FF
REV
CUE
QUICK
SLOW
FRAME
A·DUB
REC
PLAY
S653
S654
S655
S656
S657
S658
S659
S660
S661
S662
S663
S664

D651～D657
SLR-54UR
D658,659,661
DS442 or 1S2076
ZD651
GZA5.1(X,Y) or RD5.1E(B3)
or EQA02-05(C,D)
ZD652
GZA10(Y) or RD10E(B3)
or EQA02-10(B)

NOTES:
All voltage are in PLAY,RECORD and STOP mode unless otherwise noted.
(R)=RECORD mode only
(S)=STOP mode only

NOTES:
1. All resistance values in "OHMS"unless otherwise noted.(K=1,000 M=1,000,000)
2. All inductance values in "mH"unless otherwise noted.μ=micro henry.

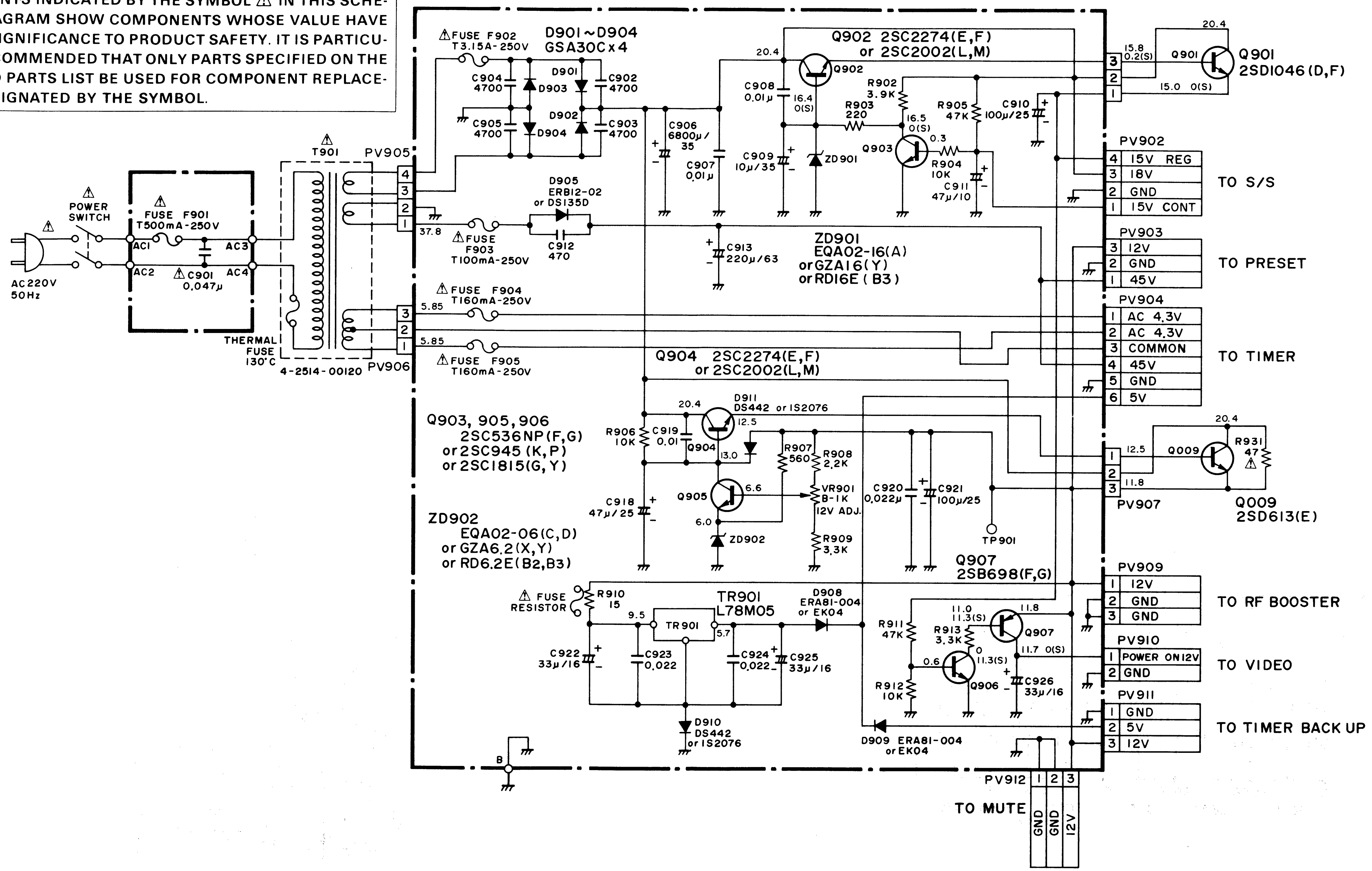
KEY FUNCTION P.C.B.


GCMK-77X
4-2264-004900
PAUSE/STILL
STOP
PLAY
REC
AUD DUB
D654
D655
D651
D652
D653
PAUSE/STILL
PLAY
REC
AUD DUB
CUE
REVIEW
FRAME
R688
E
C
B
R681
C651
S664
R673
R672
R671
S663
BR651
14
10
5
1
S658
S657
S661
S653
FF
STOP
R675
REW
S662
QUICK
SLOW
S660
ZD651
D661
ZD652
S659
S656
R685
R684
R683
R682
S654
S655
R677
R676
R679
TIMER
POWER
R687
R674
R689
D659
C652
D657
R678
D656
NC
C
NO
11 10 9 8 7 6 5 4 3 2 1
PV655
1 2 3 4 5 6 7
PV652
1 2 3
PV651
D658
1 2 3 4 8
PV653
1 2
PV656
R686
S651
S652
J

POWER CIRCUIT DIAGRAM

PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A UNIT. COMPONENTS INDICATED BY THE SYMBOL ⚠ IN THIS SCHEMATIC DIAGRAM SHOW COMPONENTS WHOSE VALUE HAVE SPECIAL SIGNIFICANCE TO PRODUCT SAFETY. IT IS PARTICULARLY RECOMMENDED THAT ONLY PARTS SPECIFIED ON THE ATTACHED PARTS LIST BE USED FOR COMPONENT REPLACEMENT DESIGNATED BY THE SYMBOL.

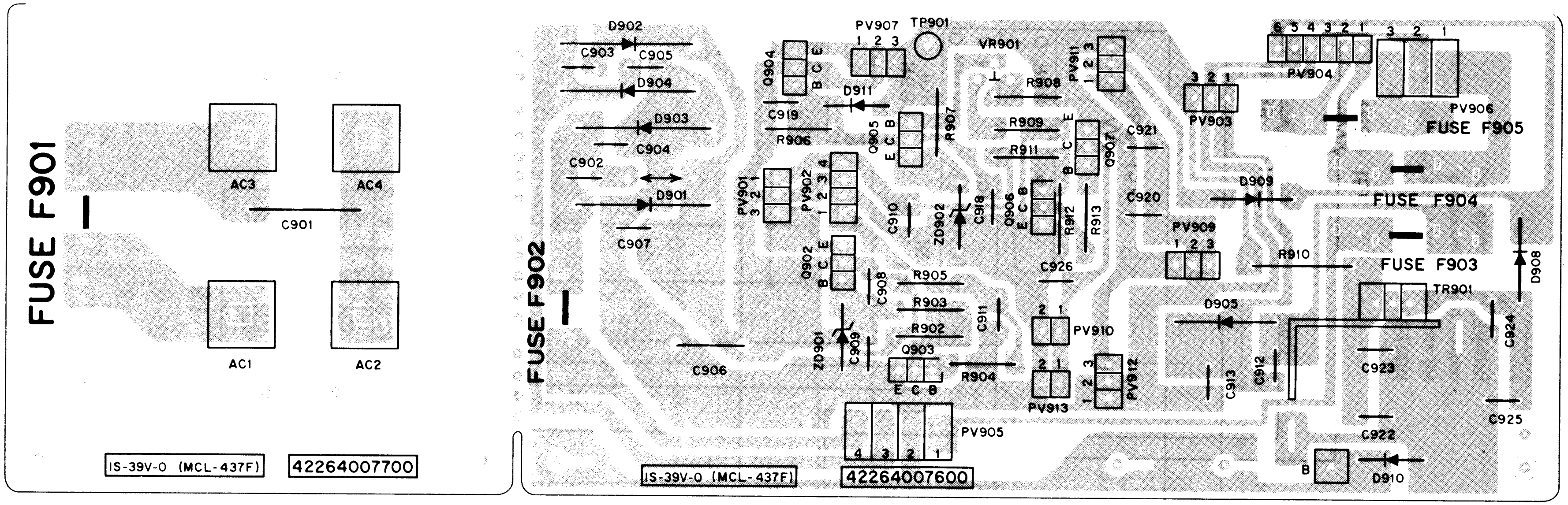


AC220V 50Hz
⚠ POWER SWITCH
⚠ FUSE F901 T500mA-250V
AC1
AC2
AC3
AC4
⚠ C901 0.047μ
⚠ T901
PV905
PV906
THERMAL FUSE 130°C
4-2514-00120
⚠ FUSE F902 T3.15A-250V
D901~D904 GSA30C x 4
C904 4700
C905 4700
C902 4700
C903 4700
D901
D902
D903
D904
C906 6800μ/35
C907 0.01μ
D905 ERB12-02 or DS135D
37.8
⚠ FUSE F903 T100mA-250V
C912 470
C913 220μ/63
⚠ FUSE F904 T160mA-250V
5.85
5.85
⚠ FUSE F905 T160mA-250V
Q902 2SC2274(E,F) or 2SC2002(L,M)
20.4
C908 0.01μ
16.4 0(S)
C909 10μ/35
ZD901
R902 3.9K
R903 220
16.5 0(S)
Q903
0.3
R904 10K
R905 47K
C910 100μ/25
C911 47μ/10
ZD901 EQA02-16(A) or GZA16(Y) or RD16E (B3)
Q904 2SC2274(E,F) or 2SC2002(L,M)
Q903, 905, 906 2SC536NP(F,G) or 2SC945 (K,P) or 2SC1815(G,Y)
ZD902 EQA02-06(C,D) or GZA6.2(X,Y) or RD6.2E(B2,B3)
20.4
D911 DS442 or IS2076
12.5
R906 10K
C919 0.01
Q904
13.0
R907 560
R908 2.2K
C918 47μ/25
Q905
6.6
6.0
ZD902
VR901 B-1K 12V ADJ.
R909 3.3K
C920 0.022μ
C921 100μ/25
TP901
⚠ FUSE RESISTOR
R910 15
9.5
TR901
TR901 L78M05
5.7
D908 ERA81-004 or EK04
C922 33μ/16
C923 0.022
C924 0.022
C925 33μ/16
D910 DS442 or IS2076
B
Q907 2SB698(F,G)
R911 47K
11.0 11.3(S)
11.8
R913 3.3K
Q907
0
0.6
11.3(S)
11.7 0(S)
Q906
C926 33μ/16
R912 10K
D909 ERA81-004 or EK04
20.4
15.8 0.2(S)
Q901
Q901 2SD1046(D,F)
15.0 0(S)
PV902
4 15V REG
3 18V
2 GND
1 15V CONT
TO S/S
PV903
3 12V
2 GND
1 45V
TO PRESET
PV904
1 AC 4.3V
2 AC 4.3V
3 COMMON
4 45V
5 GND
6 5V
TO TIMER
20.4
12.5
Q009
R931 47 ⚠
11.8
PV907
Q009 2SD613(E)
PV909
1 12V
2 GND
3 GND
TO RF BOOSTER
PV910
1 POWER ON 12V
2 GND
TO VIDEO
PV911
1 GND
2 5V
3 12V
TO TIMER BACK UP
PV912 1 2 3
TO MUTE
GND
GND
12V

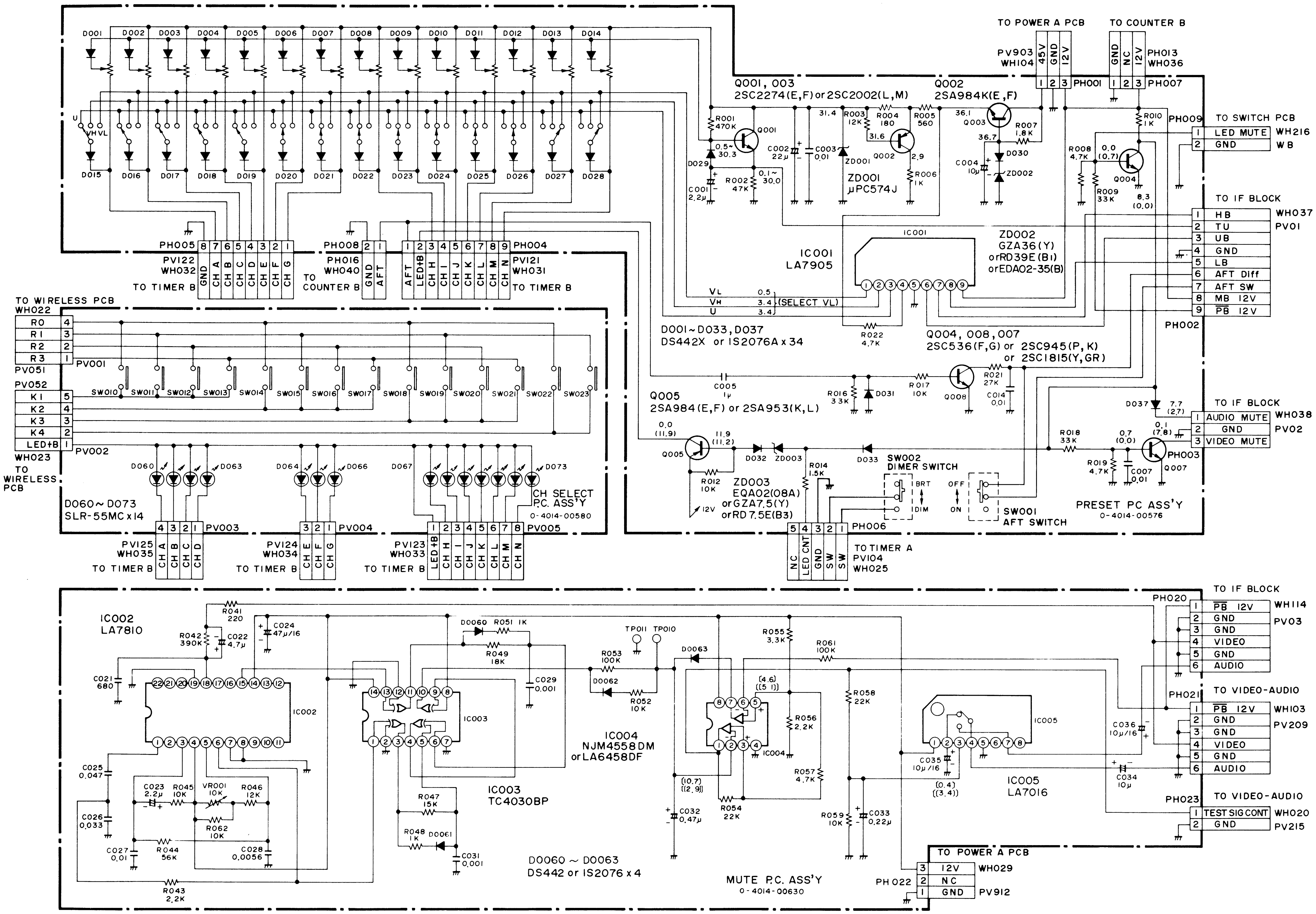
NOTES:
All voltage are in PLAY and RECORD mode unless otherwise noted.
(S)=STOP mode only

NOTES:
1. All resistance values in "OHMS" unless otherwise noted.(K=1,000 M=1,000,000)
2. All inductance values in "mH" unless otherwise noted.μ=micro henry.

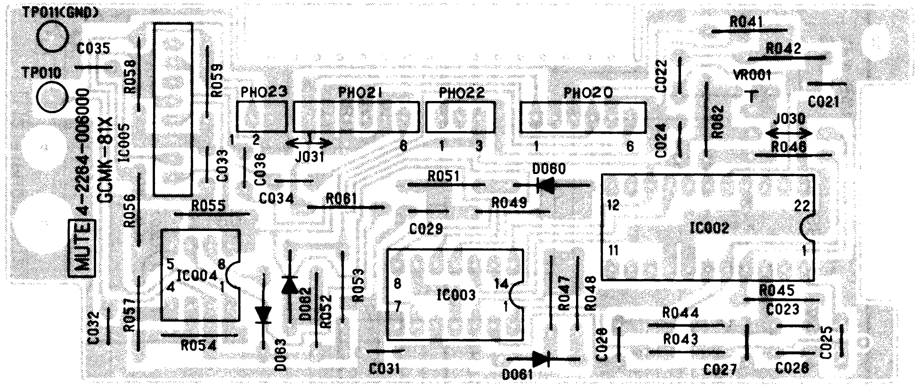
POWER CIRCUIT P.C.B.


FUSE F901
AC3
AC4
C901
AC1
AC2
IS-39V-0 (MCL-437F)
42264007700
FUSE F902
D902
C903
C905
D904
D903
C904
C902
D901
C907
C906
Q904
B C E
PV907
1 2 3
TP901
VR901
D911
C919
R906
Q905
E C B
R907
PV911
1 2 3
R908
R909
R911
Q907
B C E
C921
PV901
3 2 1
PV902
1 2 3 4
C910
ZD902
C918
Q906
E C B
R912
R913
C920
Q902
B C E
C908
R905
R903
R902
C926
C911
ZD901
C909
Q903
E C B
R904
PV910
2 1
PV913
2 1
PV912
1 2 3
PV905
4 3 2 1
IS-39V-0 (MCL-437F)
42264007600
6 5 4 3 2 1
PV904
3 2 1
PV906
PV903
3 2 1
FUSE F905
D909
FUSE F904
PV909
1 2 3
R910
FUSE F903
D908
TR901
D905
C913
C912
C923
C924
C922
C925
B
D910

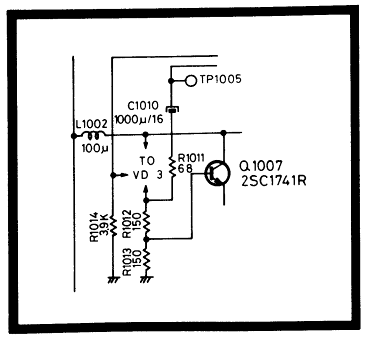
PRESET MUTE DIAGRAM


TO POWER A PCB
TO COUNTER B
PV903
WH104
45V
GND
12V
PH001
GND
NC
12V
PH013
WH036
PH007
Q001, 003
2SC2274(E,F) or 2SC2002(L,M)
Q002
2SA984K(E,F)
D001
D002
D003
D004
D005
D006
D007
D008
D009
D010
D011
D012
D013
D014
D015
D016
D017
D018
D019
D020
D021
D022
D023
D024
D025
D026
D027
D028
U
VH
VL
R001 470K
Q001
0.5~30.3
D029
C001 2.2μ
R002 47K
0.1~30.0
C002 22μ
C003 0.01
31.4
R003 12K
R004 180
R005 560
31.6
Q002
2.9
R006 1K
ZD001
ZD001
μPC574J
36.1
Q003
36.7
R007 1.8K
C004 10μ
D030
ZD002
R008 4.7K
0.0 (0.7)
R009 33K
Q004
8.3 (0.0)
R010 1K
PH009
TO SWITCH PCB
LED MUTE
GND
WH216
WB
TO IF BLOCK
HB
TU
UB
GND
LB
AFT Diff
AFT SW
MB 12V
PB 12V
WH037
PV01
PH002
IC001
IC001
LA7905
ZD002
GZA36(Y)
or RD39E(B1)
or EDA02-35(B)
VL 0.5
VH 3.4
U 3.4 (SELECT VL)
R022 4.7K
D001~D033, D037
DS442X or IS2076A x 34
Q004, 008, 007
2SC536(F,G) or 2SC945(P,K)
or 2SC1815(Y,GR)
PH005
PV122
WH032
TO TIMER B
GND
CH A
CH B
CH C
CH D
CH E
CH F
CH G
PH008
PH016
WH040
TO COUNTER B
GND
AFT
PH004
AFT
LED+B
CH H
CH I
CH J
CH K
CH L
CH M
CH N
PV121
WH031
TO TIMER B
TO WIRELESS PCB
WH022
R0
R1
R2
R3
PV051
PV001
PV052
K1
K2
K3
K4
LED+B
WH023
TO WIRELESS PCB
PV002
SW010
SW011
SW012
SW013
SW014
SW015
SW016
SW017
SW018
SW019
SW020
SW021
SW022
SW023
C005 1μ
R016 3.3K
D031
R017 10K
Q008
R021 27K
C014 0.01
Q005
2SA984(E,F) or 2SA953(K,L)
0.0 (11.9)
11.9 (11.2)
Q005
R012 10K
12V
D032
ZD003
ZD003
EQA02(08A)
or GZA7.5(Y)
or RD7.5E(B3)
R014 1.5K
D033
SW002
DIMER SWITCH
BRT
DIM
OFF
ON
SW001
AFT SWITCH
D037
7.7 (2.7)
R018 33K
0.7 (0.0)
0.1 (7.8)
R019 4.7K
C007 0.01
Q007
PH003
TO IF BLOCK
AUDIO MUTE
GND
VIDEO MUTE
WH038
PV02
PRESET PC ASS'Y
0-4014-00576
D060
D063
D064
D066
D067
D073
D060~D073
SLR-55MC x 14
CH SELECT P.C. ASS'Y
0-4014-00580
PV003
PV004
PV005
PV125
WH035
TO TIMER B
PV124
WH034
TO TIMER B
PV123
WH033
TO TIMER B
PH006
NC
LED CNT
GND
SW
SW
TO TIMER A
PV104
WH025
IC002
LA7810
R041 220
R042 390K
C022 4.7μ
C024 47μ/16
C021 680
IC002
C025 0.047
C026 0.033
C027 0.01
C023 2.2μ
R045 10K
VR001 10K
R046 12K
R062 10K
R044 56K
C028 0.0056
R043 2.2K
D0060
R051 1K
R049 18K
C029 0.001
IC003
IC003
TC4030BP
R047 15K
R048 1K
D0061
C031 0.001
TP011
TP010
R053 100K
D0062
R052 10K
D0063
IC004
NJM4558DM
or LA6458DF
D0060 ~ D0063
DS442 or IS2076 x 4
R055 3.3K
R061 100K
(4.6) ((5.1))
R056 2.2K
R057 4.7K
R054 22K
(10.7) ((2.9))
C032 0.47μ
R058 22K
R059 10K
C033 0.22μ
IC004
IC005
IC005
LA7016
C035 10μ/16
(0.4) ((3.4))
C036 10μ/16
C034 10μ
MUTE P.C. ASS'Y
0-4014-00630
PH020
TO IF BLOCK
PB 12V
GND
GND
VIDEO
GND
AUDIO
WH114
PV03
PH021
TO VIDEO-AUDIO
PB 12V
GND
GND
VIDEO
GND
AUDIO
WH103
PV209
PH023
TO VIDEO-AUDIO
TEST SIG CONT
GND
WH020
PV215
TO POWER A PCB
12V
NC
GND
WH029
PV912
PH022

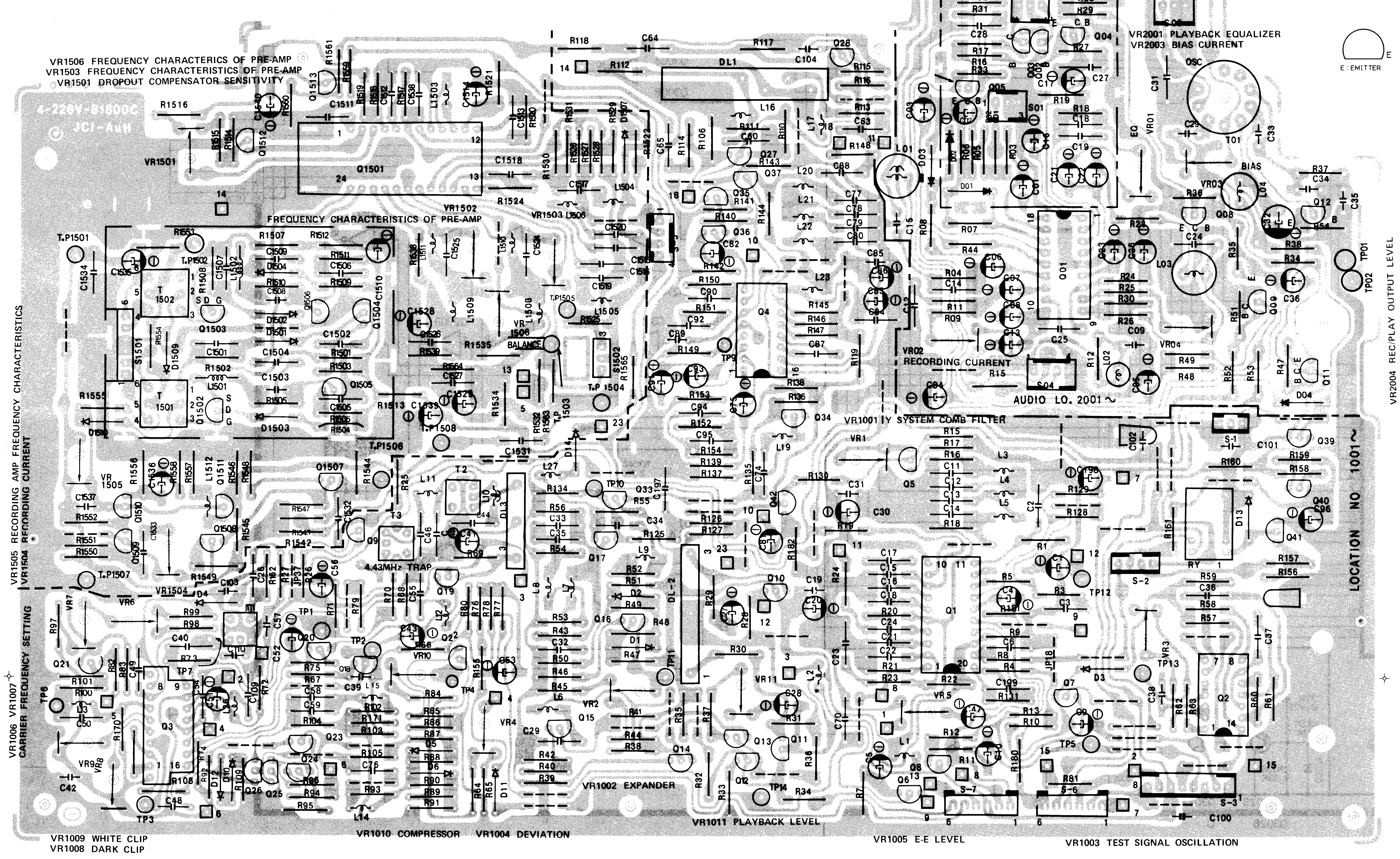
MUTE P.C.B.

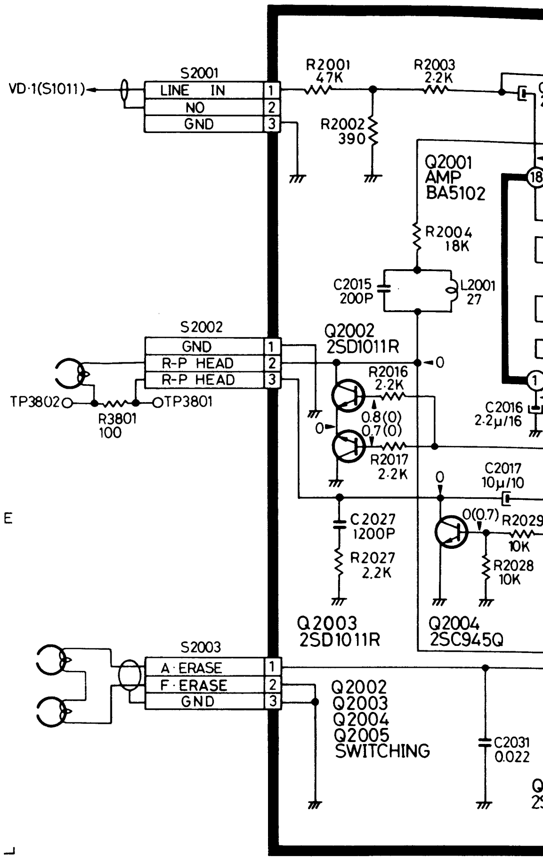

TP011(GND)
TP010
C035
R058
R059
IC005
4-2284-006000
GCMK-81X
MUTE
R056
R055
C033
C036
C034
PH023
PH021
PH022
PH020
J031
R051
D060
R061
R049
C029
IC004
R054
R057
C032
D063
D062
R052
R053
IC003
C031
D061
R047
R048
IC002
C022
C024
R062
R041
R042
VR001
C021
J030
R046
R045
C023
R044
R043
C028
C027
C026
C025

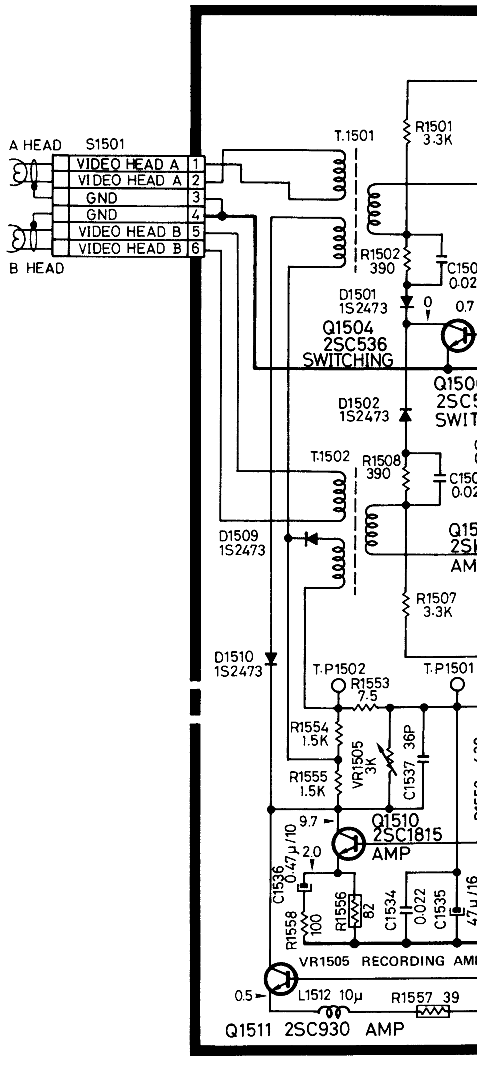
P.C.B. VD-1 (STILL)

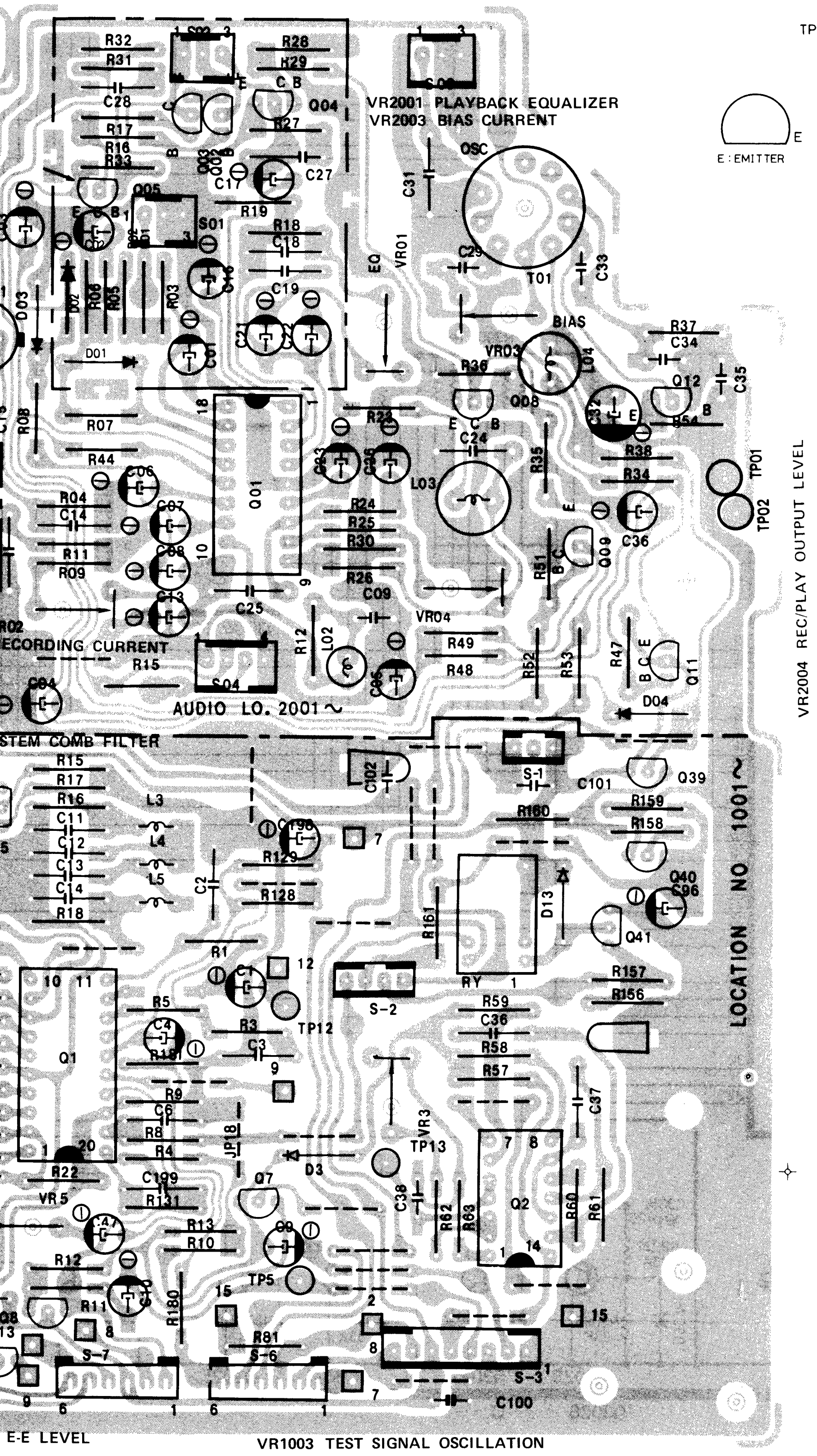

TP1005
C1010
1000μ/16
L1002
100μ
TO VD 3
R1011 68
Q1007
2SC1741R
R1014 39K
R1012 150
R1013 150

P.C.B. VD-1 VIDEO (1)/VIDEO PRE/AUDIO

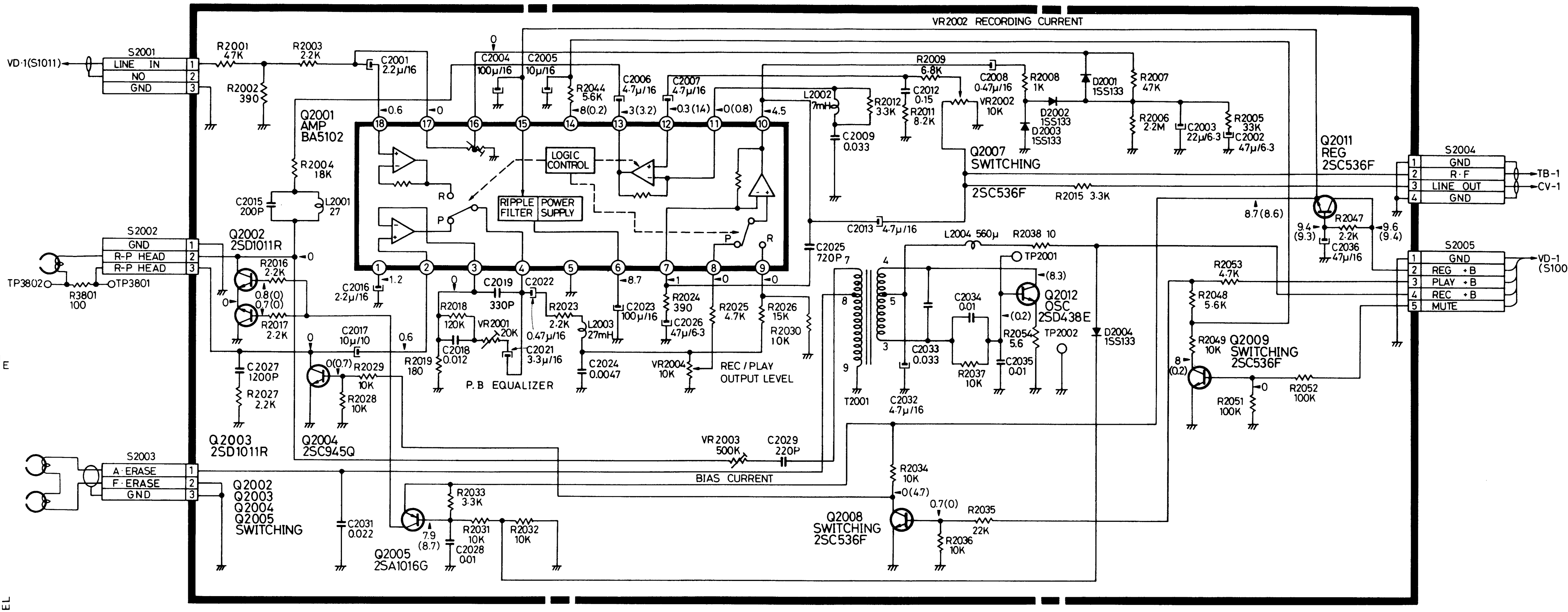

VR1506 FREQUENCY CHARACTERISTICS OF PRE-AMP
VR1503 FREQUENCY CHARACTERISTICS OF PRE-AMP
VR1501 DROPOUT COMPENSATOR SENSITIVITY
4-226V-81800C
JCI-AuH
FREQUENCY CHARACTERISTICS OF PRE-AMP
VR1505 RECORDING AMP FREQUENCY CHARACTERISTICS
VR1504 RECORDING CURRENT
VR1006 VR1007 CARRIER FREQUENCY SETTING
4.43MHz TRAP
BALANCE
VR2001 PLAYBACK EQUALIZER
VR2003 BIAS CURRENT
OSC
BIAS
VR02 RECORDING CURRENT
AUDIO LO. 2001
VR1001 Y SYSTEM COMB FILTER
LOCATION NO 1001
VR2004 REC/PLAY OUTPUT LEVEL
VR1002 EXPANDER
VR1011 PLAYBACK LEVEL
VR1009 WHITE CLIP
VR1008 DARK CLIP
VR1010 COMPRESSOR
VR1004 DEVIATION
VR1005 E-E LEVEL
VR1003 TEST SIGNAL OSCILLATION
E : EMITTER


VD-1(S1011)
S2001
LINE IN
NO
GND
R2001 47K
R2003 2.2K
R2002 390
Q2001 AMP BA5102
R2004 18K
C2015 200P
L2001 27
S2002
GND
R-P HEAD
R-P HEAD
TP3802
R3801 100
TP3801
Q2002 2SD1011R
R2016 2.2K
R2017 2.2K
C2016 2.2μ/16
C2017 10μ/10
C2027 1200P
R2027 2.2K
R2029 10K
R2028 10K
Q2003 2SD1011R
Q2004 2SC945Q
S2003
A ERASE
F ERASE
GND
Q2002
Q2003
Q2004
Q2005
SWITCHING
C2031 0.022

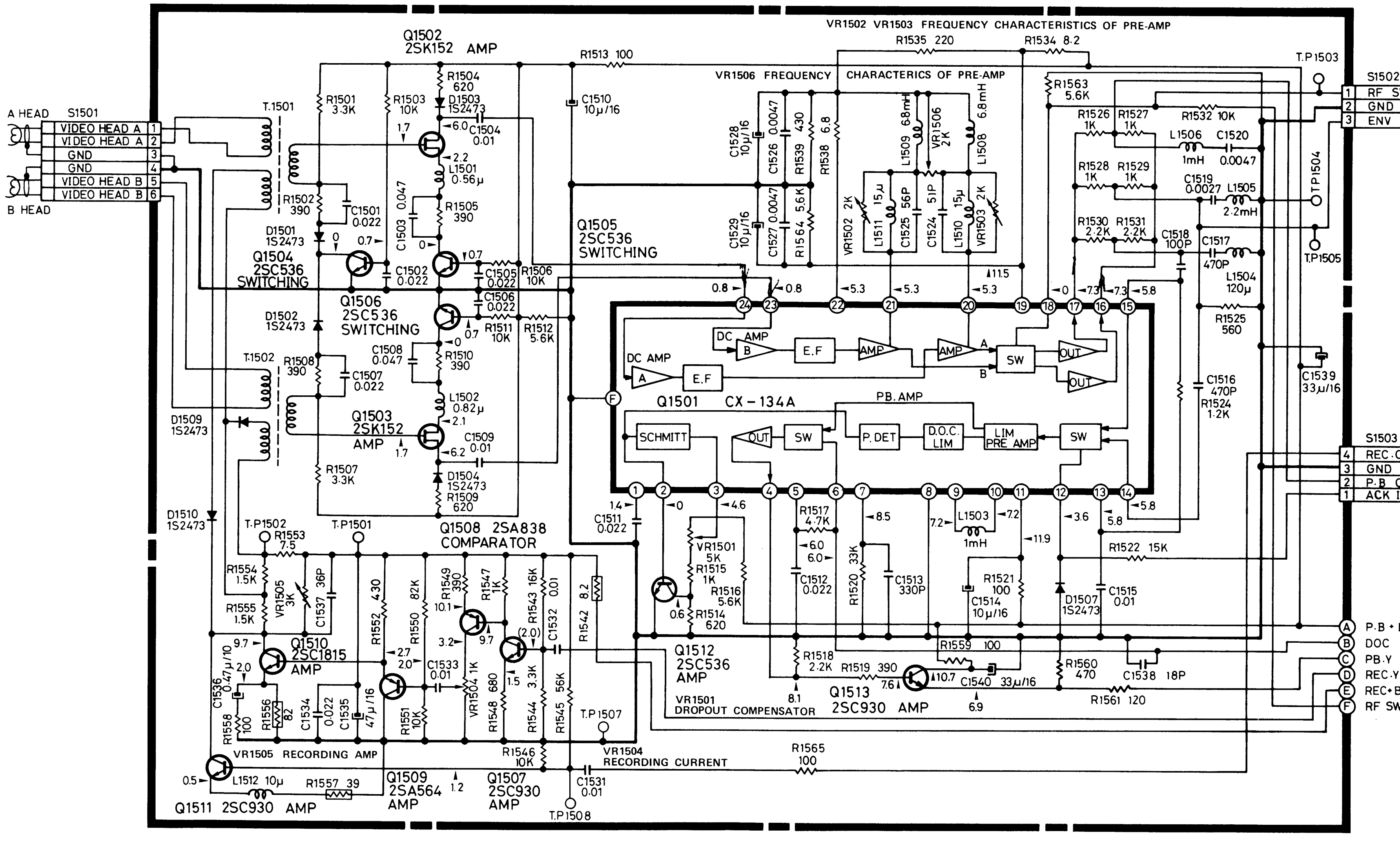

A HEAD
S1501
VIDEO HEAD A
VIDEO HEAD A
GND
GND
VIDEO HEAD B
VIDEO HEAD B
B HEAD
T.1501
R1501 3.3K
R1502 390
D1501 1S2473
Q1504 2SC536 SWITCHING
D1502 1S2473
T.1502
R1508 390
D1509 1S2473
R1507 3.3K
D1510 1S2473
T.P1502
R1553 7.5
T.P1501
R1554 1.5K
R1555 1.5K
VR1505 3K
C1537 36P
Q1510 2SC1815 AMP
C1536 0.47μ/10
R1558 100
R1556 82
C1534 0.022
C1535 47μ/16
VR1505 RECORDING AMP
L1512 10μ
R1557 39
Q1511 2SC930 AMP


VR2001 PLAYBACK EQUALIZER
VR2003 BIAS CURRENT
E : EMITTER
RECORDING CURRENT
AUDIO LO. 2001～
STEM COMB FILTER
VR2004 REC/PLAY OUTPUT LEVEL
LOCATION NO 1001～
E-E LEVEL
VR1003 TEST SIGNAL OSCILLATION
OSC
BIAS
EQ
VR01
VR03
VR04
T01
Q01
Q1
Q2
RY
TP01
TP02
TP5
TP12
TP13
S-1
S-2
S-3
S-6
S-7
S04

P.C.B. VD-1 AUDIO CIRCUIT


VR2002 RECORDING CURRENT
VD-1(S1011)
S2001
LINE IN
NO
GND
S2002
R-P HEAD
TP3802
TP3801
R3801 100
S2003
A·ERASE
F·ERASE
Q2001 AMP BA5102
LOGIC CONTROL
RIPPLE FILTER
POWER SUPPLY
Q2002 2SD1011R
Q2003 2SD1011R
Q2004 2SC945Q
Q2002 Q2003 Q2004 Q2005 SWITCHING
Q2005 2SA1016G
Q2007 SWITCHING 2SC536F
Q2008 SWITCHING 2SC536F
Q2009 SWITCHING 2SC536F
Q2011 REG 2SC536F
Q2012 OSC 2SD438E
P.B EQUALIZER
REC / PLAY OUTPUT LEVEL
BIAS CURRENT
VR2003 500K
VR2004 10K
T2001
L2002 7mH
L2003 27mH
L2004 560μ
TP2001
TP2002
D2001 1SS133
D2002 1SS133
D2003 1SS133
D2004 1SS133
S2004
R·F
LINE OUT
TB-1
CV-1
S2005
REG ·B
PLAY ·B
REC ·B
MUTE
VD-1 (S1005)

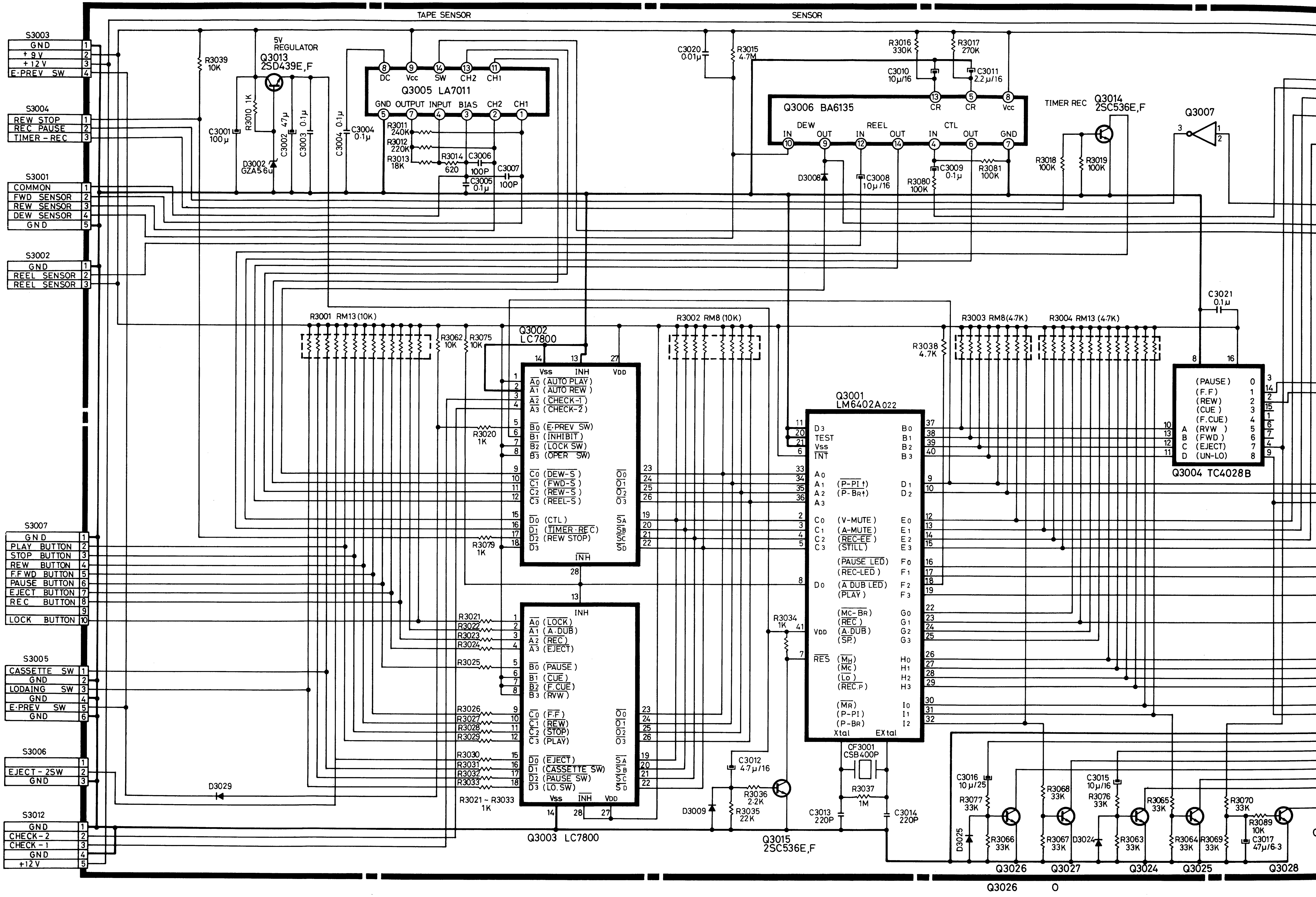
P.C.B. VD-1 VIDEO PRE-AMP CIRCUIT


VR1502 VR1503 FREQUENCY CHARACTERISTICS OF PRE-AMP
VR1506 FREQUENCY CHARACTERISTICS OF PRE-AMP
A HEAD
B HEAD
S1501
VIDEO HEAD A
VIDEO HEAD B
GND
T.1501
T.1502
Q1502 2SK152 AMP
Q1503 2SK152 AMP
Q1504 2SC536 SWITCHING
Q1505 2SC536 SWITCHING
Q1506 2SC536 SWITCHING
Q1501 CX-134A
DC AMP
E.F
AMP
SW
OUT
PB.AMP
SCHMITT
P. DET
D.O.C LIM
LIM PRE AMP
Q1508 2SA838 COMPARATOR
Q1509 2SA564 AMP
Q1507 2SC930 AMP
Q1510 2SC1815 AMP
Q1511 2SC930 AMP
Q1512 2SC536 AMP
Q1513 2SC930 AMP
VR1501 DROPOUT COMPENSATOR
VR1504 RECORDING CURRENT
VR1505 RECORDING AMP
T.P1501
T.P1502
T.P1503
T.P1504
T.P1505
T.P1507
T.P1508
S1502
RF SW
GND
ENV
S1503
REC·C
P.B C
ACK IN
Ⓐ P.B·B
Ⓑ DOC
Ⓒ PB·Y
Ⓓ REC·Y
Ⓔ REC·B
Ⓕ RF SW

Ⓒ

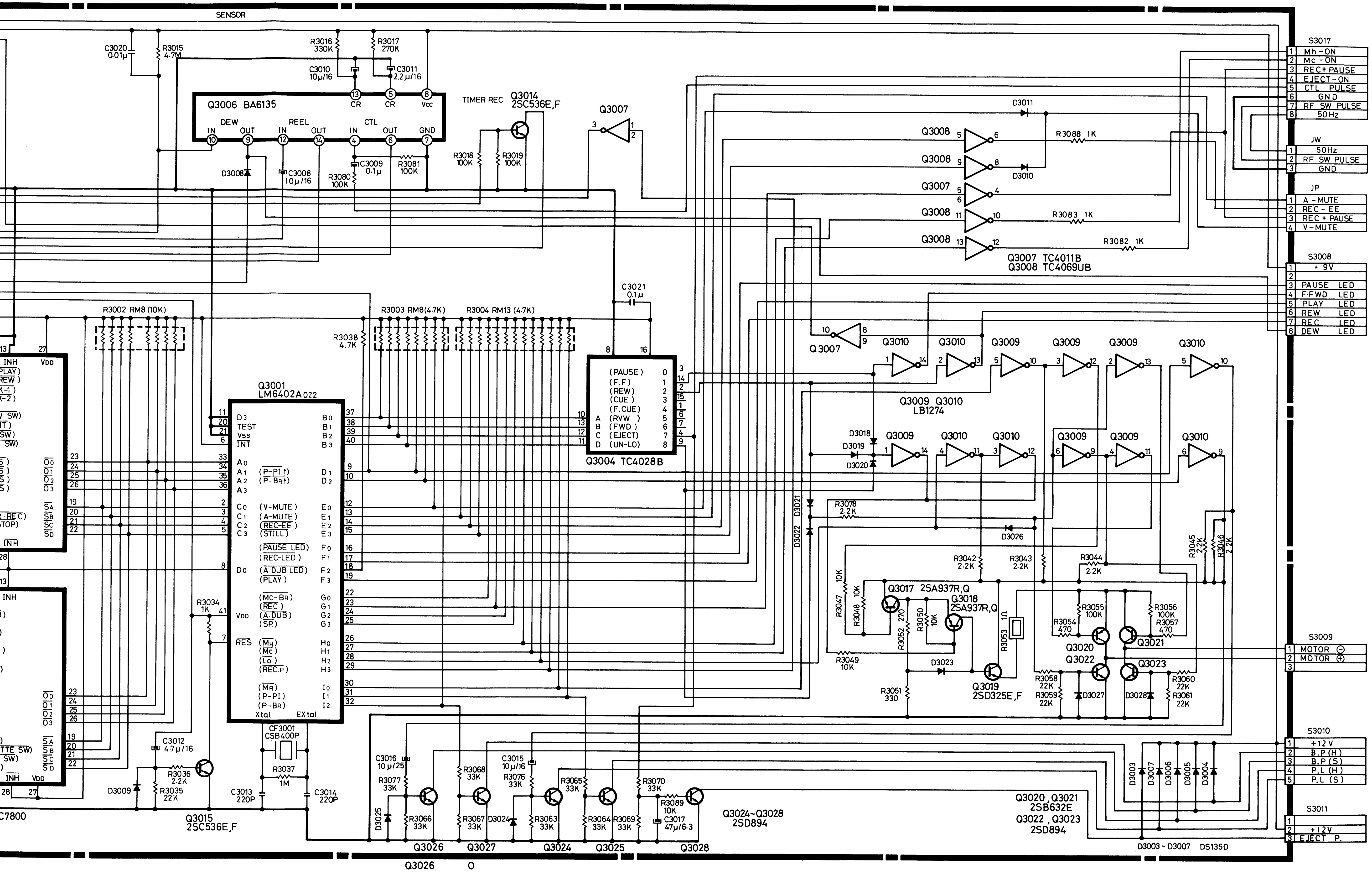
P.C.B. VD-2 SYSTEM CONTROL CIRCUIT

Ⓓ



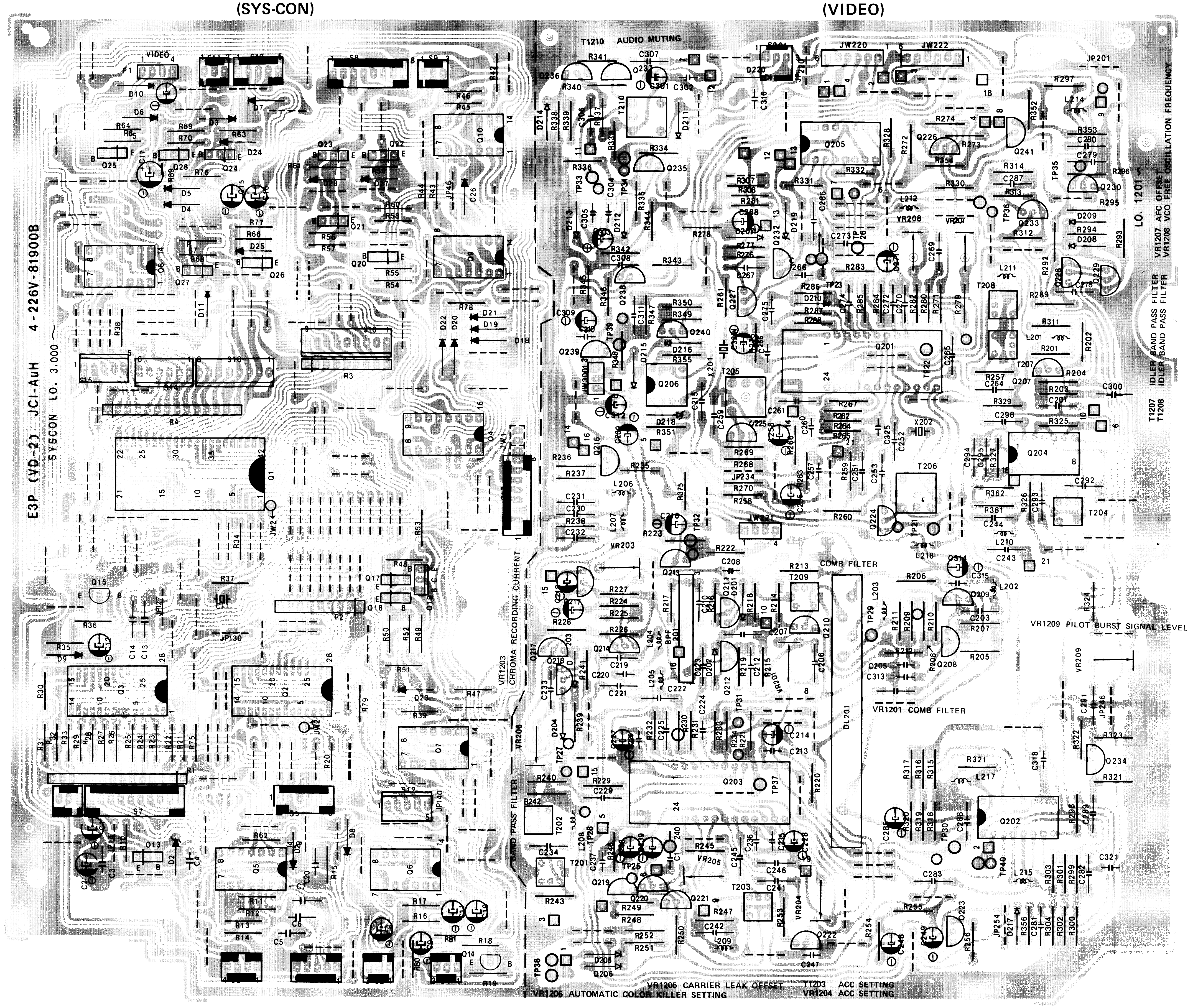
TAPE SENSOR
SENSOR
S3003
GND
+9V
+12V
E·PREV SW
S3004
REW STOP
REC PAUSE
TIMER-REC
S3001
COMMON
FWD SENSOR
REW SENSOR
DEW SENSOR
GND
S3002
GND
REEL SENSOR
REEL SENSOR
S3007
GND
PLAY BUTTON
STOP BUTTON
REW BUTTON
F.FWD BUTTON
PAUSE BUTTON
EJECT BUTTON
REC BUTTON
LOCK BUTTON
S3005
CASSETTE SW
GND
LODAING SW
GND
E·PREV SW
GND
S3006
EJECT-2SW
GND
S3012
GND
CHECK-2
CHECK-1
GND
+12V
R3039 10K
5V REGULATOR
Q3013 2SD439E,F
R3010 1K
C3001 100μ
C3002 47μ
C3003 0.1μ
D3002 GZA5.6u
C3004 0.1μ
Q3005 LA7011
DC
Vcc
SW
CH2
CH1
GND
OUTPUT
INPUT
BIAS
R3011 240K
R3012 220K
R3013 18K
R3014 620
C3006 100P
C3005 0.1μ
C3007 100P
C3020 0.01μ
R3015 4.7M
R3016 330K
R3017 270K
C3010 10μ/16
C3011 2.2μ/16
Q3006 BA6135
CR
Vcc
DEW
REEL
CTL
IN
OUT
GND
D3008
C3008 10μ/16
C3009 0.1μ
R3080 100K
R3081 100K
TIMER REC
Q3014 2SC536E,F
R3018 100K
R3019 100K
Q3007
C3021 0.1μ
R3001 RM13(10K)
R3062 10K
R3075 10K
Q3002 LC7800
Vss
INH
VDD
A0 (AUTO PLAY)
A1 (AUTO REW)
A2 (CHECK-1)
A3 (CHECK-2)
B0 (E.PREV SW)
B1 (INHIBIT)
B2 (LOCK SW)
B3 (OPER SW)
C0 (DEW-S)
C1 (FWD-S)
C2 (REW-S)
C3 (REEL-S)
D0 (CTL)
D1 (TIMER·REC)
D2 (REW STOP)
D3
O0 O1 O2 O3
SA SB SC SD
R3020 1K
R3079 1K
R3002 RM8(10K)
R3003 RM8(4.7K)
R3004 RM13(4.7K)
R3038 4.7K
Q3001 LM6402A 022
D3
TEST
Vss
INT
A0 A1 A2 A3
(P-PI↑)
(P-BR↑)
C0 C1 C2 C3
(V-MUTE)
(A-MUTE)
(REC-EE)
(STILL)
(PAUSE LED)
(REC-LED)
D0
(A DUB LED)
(PLAY)
VDD
(MC-BR)
(REC)
(REC-EE)
(SP.)
RES
(MH)
(MC)
(LO)
(REC.P)
(MR)
(P-PI)
(P-BR)
Xtal
EXtal
B0 B1 B2 B3
D1 D2
E0 E1 E2 E3
F0 F1 F2 F3
G0 G1 G2 G3
H0 H1 H2 H3
I0 I1 I2
R3034 1K
CF3001 CSB400P
R3037 1M
C3013 220P
C3014 220P
Q3004 TC4028B
(PAUSE) 0
(F.F) 1
(REW) 2
(CUE) 3
(F.CUE) 4
A (RVW) 5
B (FWD) 6
C (EJECT) 7
D (UN-LO) 8
Q3003 LC7800
A0 (LOCK)
A1 (A.DUB)
A2 (REC)
A3 (EJECT)
B0 (PAUSE)
B1 (CUE)
B2 (F.CUE)
B3 (RVW)
C0 (F.F)
C1 (REW)
C2 (STOP)
C3 (PLAY)
D0 (EJECT)
D1 (CASSETTE SW)
D2 (PAUSE SW)
D3 (LO. SW)
R3021 R3022 R3023 R3024 R3025
R3026 R3027 R3028 R3029
R3030 R3031 R3032 R3033
R3021~R3033 1K
D3029
C3012 4.7μ/16
R3036 2.2K
R3035 22K
D3009
Q3015 2SC536E,F
C3016 10μ/25
R3077 33K
D3025
R3066 33K
Q3026
R3068 33K
R3067 33K
D3024
Q3027
C3015 10μ/16
R3076 33K
R3063 33K
Q3024
R3065 33K
R3064 33K
R3069 33K
Q3025
R3070 33K
R3089 10K
C3017 47μ/6.3
Q3028
Q3026 0

P.C.B. VD-2 SYSTEM CONTROL CIRCUIT

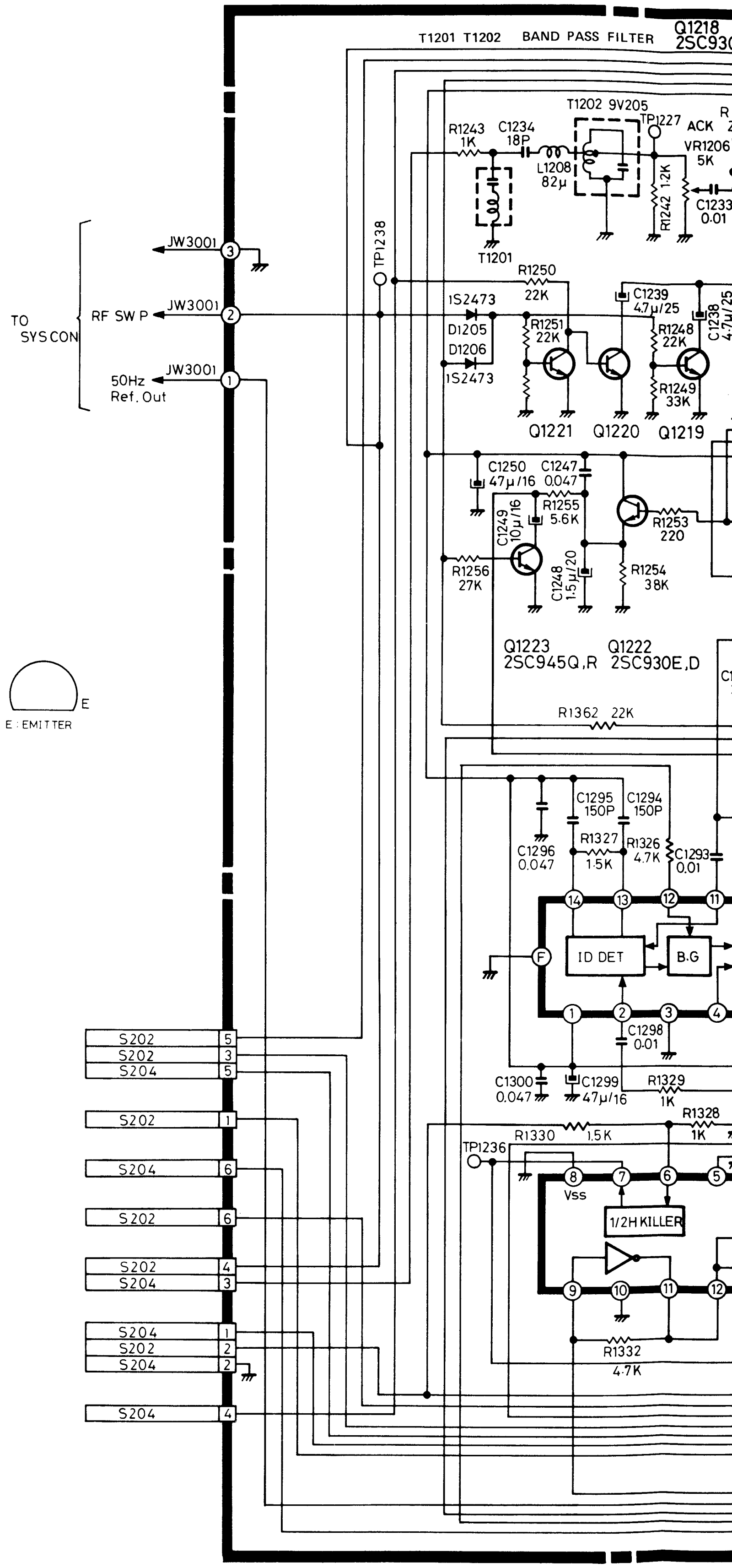

SENSOR
C3020 0.01µ
R3015 4.7M
R3016 330K
R3017 270K
C3010 10µ/16
C3011 2.2µ/16
Q3006 BA6135
DEW
REEL
CTL
IN
OUT
GND
CR
Vcc
D3008
C3008 10µ/16
C3009 0.1µ
R3080 100K
R3081 100K
TIMER REC
Q3014 2SC536E,F
R3018 100K
R3019 100K
Q3007
D3011
D3010
R3088 1K
R3083 1K
R3082 1K
Q3008
Q3007 TC4011B
Q3008 TC4069UB
S3017
1 Mh-ON
2 Mc-ON
3 REC+PAUSE
4 EJECT-ON
5 CTL PULSE
6 GND
7 RF SW PULSE
8 50Hz
JW
1 50Hz
2 RF SW PULSE
3 GND
JP
1 A-MUTE
2 REC-EE
3 REC+PAUSE
4 V-MUTE
S3008
1 +9V
2
3 PAUSE LED
4 F.FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED
C3021 0.1µ
R3002 RM8 (10K)
R3003 RM8(4.7K)
R3004 RM13 (4.7K)
R3038 4.7K
Q3001 LM6402A022
D3 TEST Vss INT
A0 A1 A2 A3
(P-PI↑) (P-BR↑)
C0 C1 C2 C3
(V-MUTE) (A-MUTE) (REC-EE) (STILL)
(PAUSE LED) (REC-LED) (A DUB LED) (PLAY)
D0
(Mc-BR) (REC) (A-DUB) (SP)
VDD
RES
(MH) (Mc) (Lo) (REC.P)
(MR) (P-PI) (P-BR)
Xtal EXtal
B0 B1 B2 B3
D1 D2
E0 E1 E2 E3
F0 F1 F2 F3
G0 G1 G2 G3
H0 H1 H2 H3
I0 I1 I2
Q3004 TC4028B
(PAUSE) (F.F) (REW) (CUE) (F.CUE) A (RVW) B (FWD) C (EJECT) D (UN-LO)
Q3007
Q3009 Q3010 LB1274
Q3009
Q3010
D3018 D3019 D3020
D3021 D3022
R3078 2.2K
D3026
R3042 2.2K
R3043 2.2K
R3044 2.2K
R3045 2.2K
R3046 2.2K
R3047 10K
R3048 10K
Q3017 2SA937R,Q
Q3018 2SA937R,Q
R3052 270
R3050 10K
R3053 1Ω
R3049 10K
D3023
R3051 330
Q3019 2SD325E,F
R3055 100K
R3054 470
R3056 100K
R3057 470
Q3020 Q3021 Q3022 Q3023
R3058 22K
R3059 22K
D3027
D3028
R3060 22K
R3061 22K
S3009
1 MOTOR ⊖
2 MOTOR ⊕
3
INH
PLAY
REW
SW
VDD
INH
TTE SW
C7800
R3034 1K
C3012 4.7µ/16
R3036 2.2K
R3035 22K
D3009
Q3015 2SC536E,F
CF3001 CSB400P
R3037 1M
C3013 220P
C3014 220P
C3016 10µ/25
R3077 33K
D3025
R3066 33K
R3068 33K
R3067 33K
C3015 10µ/16
R3076 33K
D3024
R3063 33K
R3065 33K
R3064 33K
R3069 33K
R3070 33K
R3089 10K
C3017 47µ/6.3
Q3026 Q3027 Q3024 Q3025 Q3028
Q3024~Q3028 2SD894
Q3020, Q3021 2SB632E
Q3022, Q3023 2SD894
D3003 D3007 D3006 D3005 D3004
S3010
1 +12V
2 B.P (H)
3 B.P (S)
4 P.L (H)
5 P.L (S)
S3011
1
2 +12V
3 EJECT P.
D3003~D3007 DS135D
Q3026 O

P.C.B. VD-2 VIDEO (2)/SYS-CON

(SYS-CON) (VIDEO)

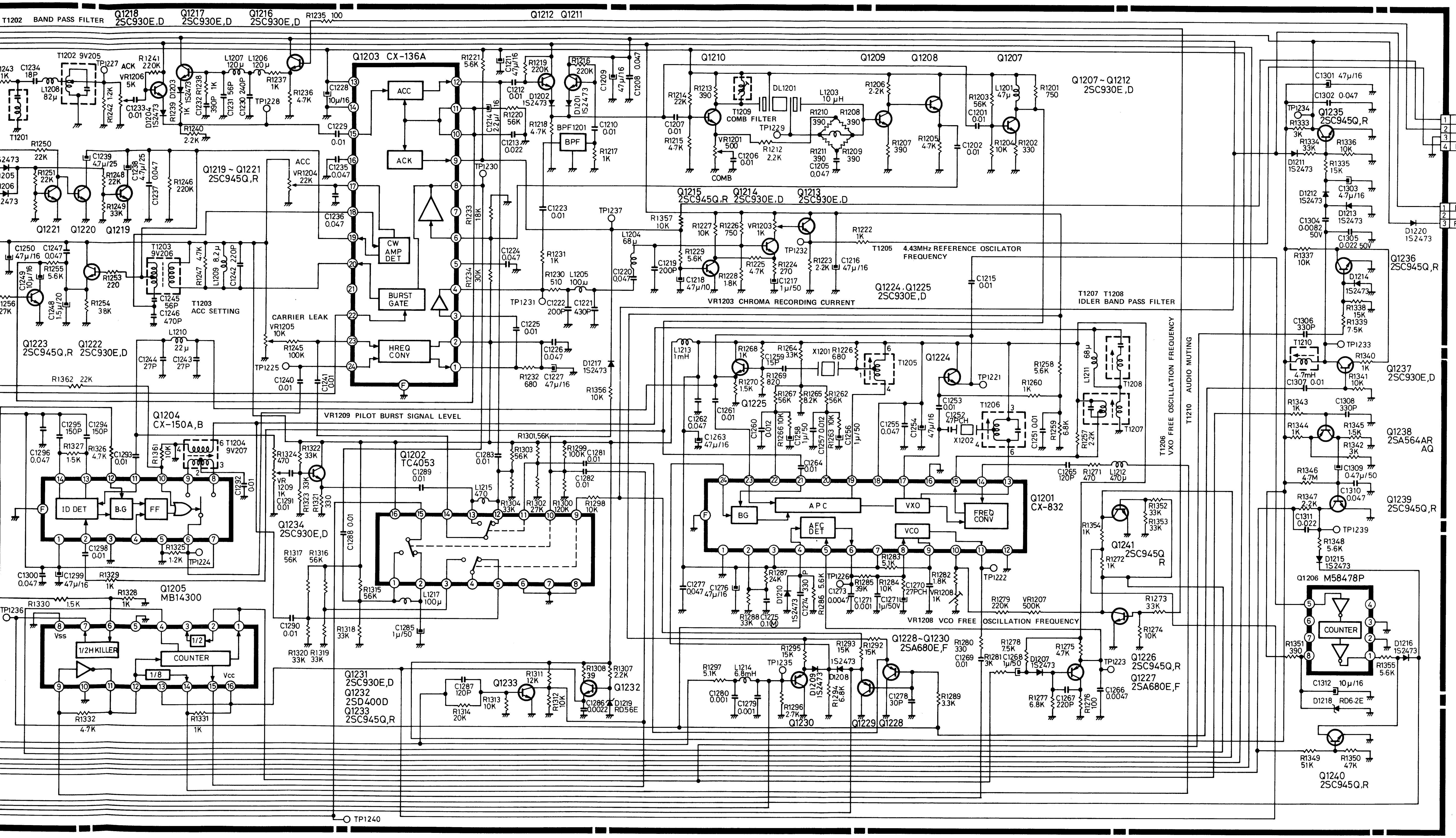


T1210 AUDIO MUTING
E3P (VD-2) JCI-AuH 4-226V-81900B
SYSCON LO. 3.000
LO. 1201
VR1207 AFC OFFSET
VR1208 VCO FREE OSCILLATION FREQUENCY
T1207 IDLER BAND PASS FILTER
T1208 IDLER BAND PASS FILTER
COMB FILTER
VR1201 COMB FILTER
VR1209 PILOT BURST SIGNAL LEVEL
VR1203 CHROMA RECORDING CURRENT
BAND PASS FILTER
VR1205 CARRIER LEAK OFFSET
VR1206 AUTOMATIC COLOR KILLER SETTING
T1203 ACC SETTING
VR1204 ACC SETTING



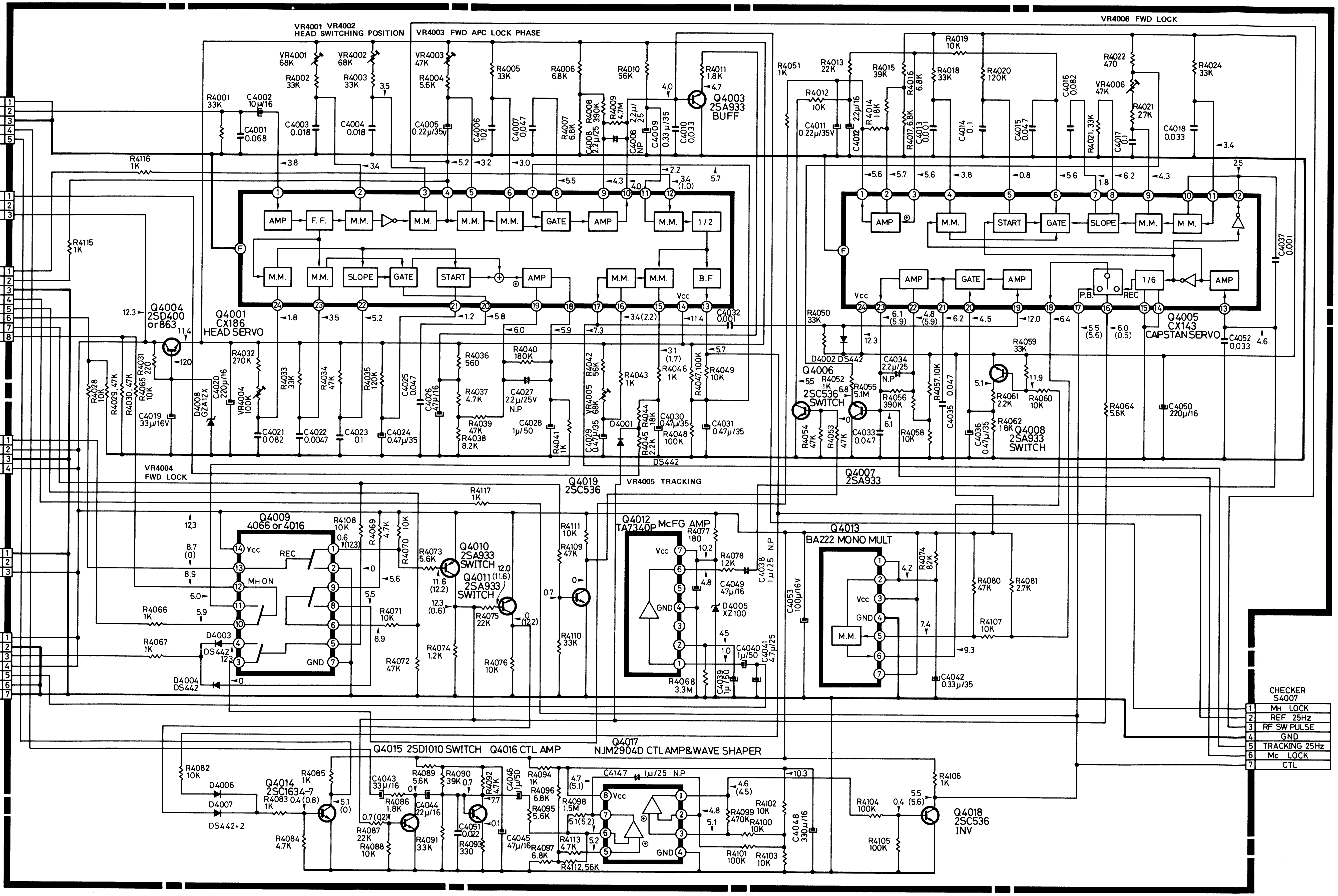
T1201 T1202 BAND PASS FILTER
Q1218 2SC930
TO SYSCON
RF SW P
50Hz Ref. Out
JW3001
E: EMITTER
Q1221 Q1220 Q1219
Q1223 2SC945Q,R
Q1222 2SC930E,D
ID DET
B.G
1/2H KILLER
Vss
S202
S204

P.C.B. VD-2 VIDEO (2) CIRCUIT

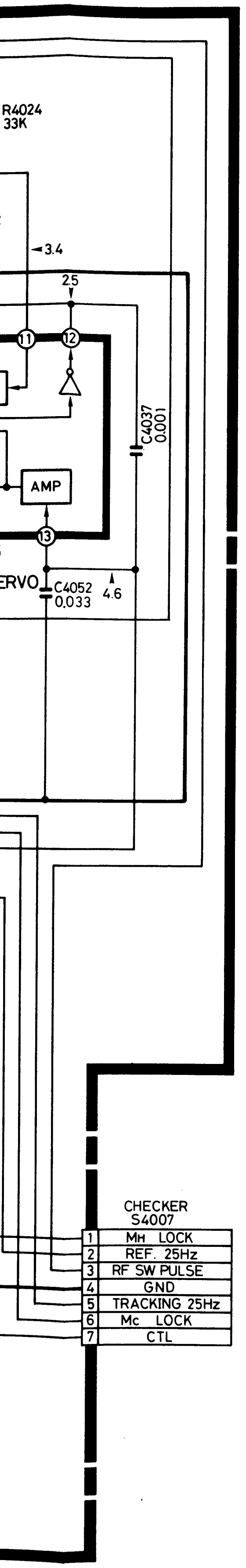

T1202 BAND PASS FILTER
Q1218 2SC930E,D
Q1217 2SC930E,D
Q1216 2SC930E,D
R1235 100
Q1212 Q1211
Q1203 CX-136A
ACC
ACK
CW AMP DET
BURST GATE
HREQ CONV
CARRIER LEAK
VR1205 10K
R1245 100K
TP1225
TP1227
TP1228
TP1230
TP1231
TP1237
VR1209 PILOT BURST SIGNAL LEVEL
Q1219~Q1221 2SC945Q,R
VR1204 22K
T1203 9V206
T1203 ACC SETTING
Q1223 2SC945Q,R
Q1222 2SC930E,D
R1362 22K
Q1221 Q1220 Q1219
T1201
BPF1201
BPF
Q1210
Q1209
Q1208
Q1207
Q1207~Q1212 2SC930E,D
DL1201
L1203 10μH
T1209 COMB FILTER
TP1229
VR1201 500
COMB
Q1215 2SC945Q,R
Q1214 2SC930E,D
Q1213 2SC930E,D
VR1203 1K
TP1232
T1205 4.43MHz REFERENCE OSCILATOR FREQUENCY
Q1224, Q1225 2SC930E,D
VR1203 CHROMA RECORDING CURRENT
T1207 T1208 IDLER BAND PASS FILTER
T1206 VXO FREE OSCILLATION FREQUENCY
T1210 AUDIO MUTING
S203
1 ACK OUT
2 PB CHROMA
3 GND
4 REC CHROMA
S1201
1 PB+12V
2
3 FTZ OUT
Q1235 2SC945Q,R
Q1236 2SC945Q,R
Q1237 2SC930E,D
Q1238 2SA564AR AQ
Q1239 2SC945Q,R
Q1240 2SC945Q,R
Q1241 2SC945Q R
D1220 1S2473
TP1233
TP1234
TP1239
Q1204 CX-150A,B
ID DET
B.G
FF
T1204 9V207
TP1224
Q1205 MB14300
Vss
1/2H KILLER
COUNTER
1/2
1/8
Vcc
TP1236
Q1234 2SC930E,D
Q1202 TC4053
L1215 470
L1217 100μ
X1201
X1202
Q1224
Q1225
TP1221
TP1222
TP1223
TP1226
Q1201 CX-832
BG
APC
AFC DET
VXO
VCO
FREQ CONV
VR1208 VCO FREE OSCILLATION FREQUENCY
VR1207 500K
Q1231 2SC930E,D
Q1232 2SD400D
Q1233 2SC945Q,R
Q1228~Q1230 2SA680E,F
Q1226 2SC945Q,R
Q1227 2SA680E,F
TP1235
D1219 RD56E
Q1206 M58478P
COUNTER
D1216 1S2473
D1218 RD6.2E
D1215 1S2473
TP1240

E

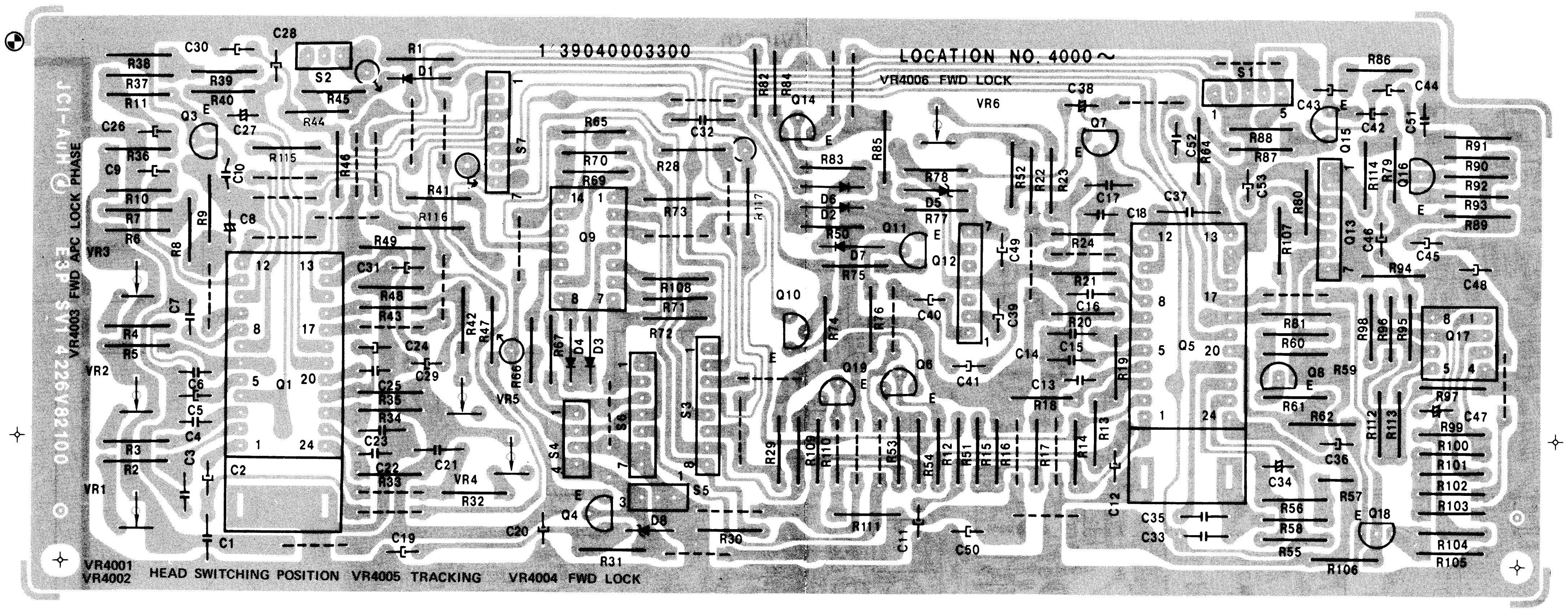
P.C.B. SV-1 SERVO CIRCUIT



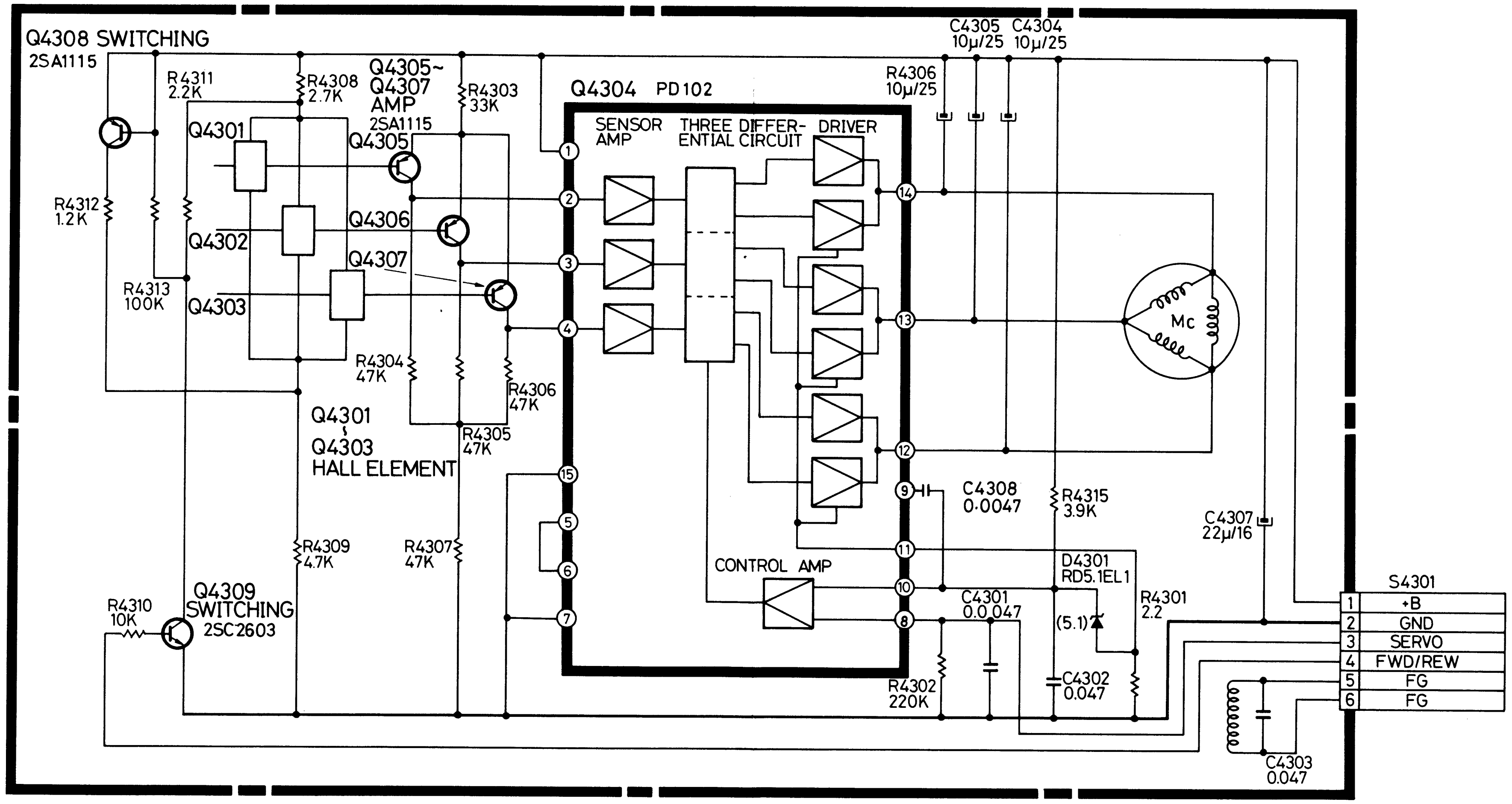
VR4001 VR4002 HEAD SWITCHING POSITION
VR4003 FWD APC LOCK PHASE
VR4006 FWD LOCK
S4001
MH PG ⊖
MH PG ⊕
GND
CTL PLY
CTL REC
S4002
TRACKING ⊖
TRACKING ⊕
S4003
REF 50Hz
RF SW PULSE
GND
CTL
EJECT
REC V PAUSE
Mc ON
MH ON
S4004
MH SERVO
MH +B
GND
+B
S4005
GND
REG 12V
S4006
Mc +B OUT
GND
Mc SERVO OUT
FWD/REV OUT
FG ⊕ IN
FG ⊖ IN
GND
Q4001 CX186 HEAD SERVO
Q4003 2SA933 BUFF
Q4004 2SD400 or 863
Q4005 CX143 CAPSTAN SERVO
Q4006 2SC536 SWITCH
Q4007 2SA933
Q4008 2SA933 SWITCH
Q4009 4066 or 4016
Q4010 2SA933 SWITCH
Q4011 2SA933 SWITCH
Q4012 TA7340P McFG AMP
Q4013 BA222 MONO MULT
Q4014 2SC1634-7
Q4015 2SD1010 SWITCH
Q4016 CTL AMP
Q4017 NJM2904D CTL AMP & WAVE SHAPER
Q4018 2SC536 INV
Q4019 2SC536
VR4004 FWD LOCK
VR4005 TRACKING
D4001 DS442
D4002 DS442
D4003 DS442
D4004 DS442
D4005 XZ100
D4006
D4007
DS442·2
D4008 GZA12X
AMP
F.F.
M.M.
GATE
SLOPE
START
1/2
B.F
1/6
P.B.
REC
Vcc
GND
MH ON
CHECKER S4007
MH LOCK
REF. 25Hz
RF SW PULSE
GND
TRACKING 25Hz
Mc LOCK
CTL


R4024
33K
3.4
25
11
12
AMP
13
ERVO
C4052
0.033
4.6
C4037
0.001
CHECKER
S4007
1 MH LOCK
2 REF. 25Hz
3 RF SW PULSE
4 GND
5 TRACKING 25Hz
6 Mc LOCK
7 CTL

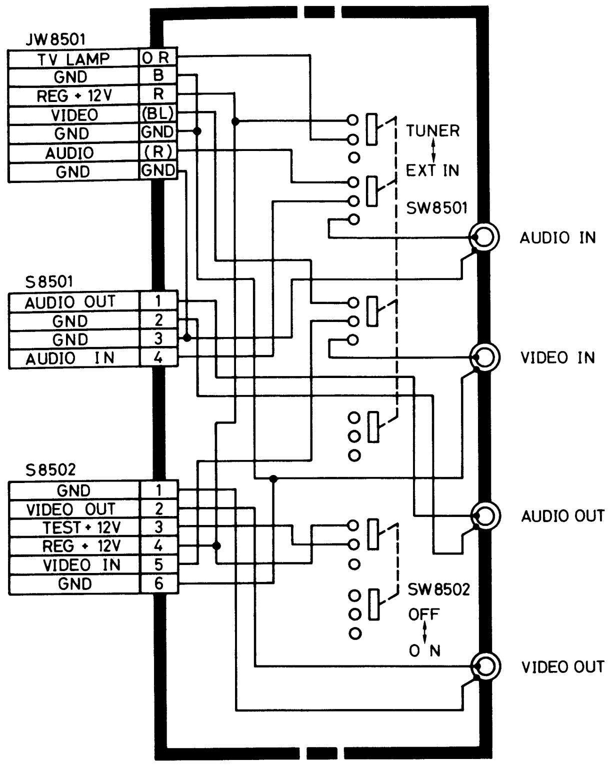
P.C.B. SV-1 SERVO


1 39040003300
LOCATION NO. 4000~
JCI-4UH
E&P SV1 4 226V92100
VR4003 FWD APC LOCK PHASE
VR4006 FWD LOCK
VR4001
VR4002
HEAD SWITCHING POSITION
VR4005 TRACKING
VR4004 FWD LOCK
Q1
Q5
Q9
S1
S2
S3
S4
S5
S6
S7

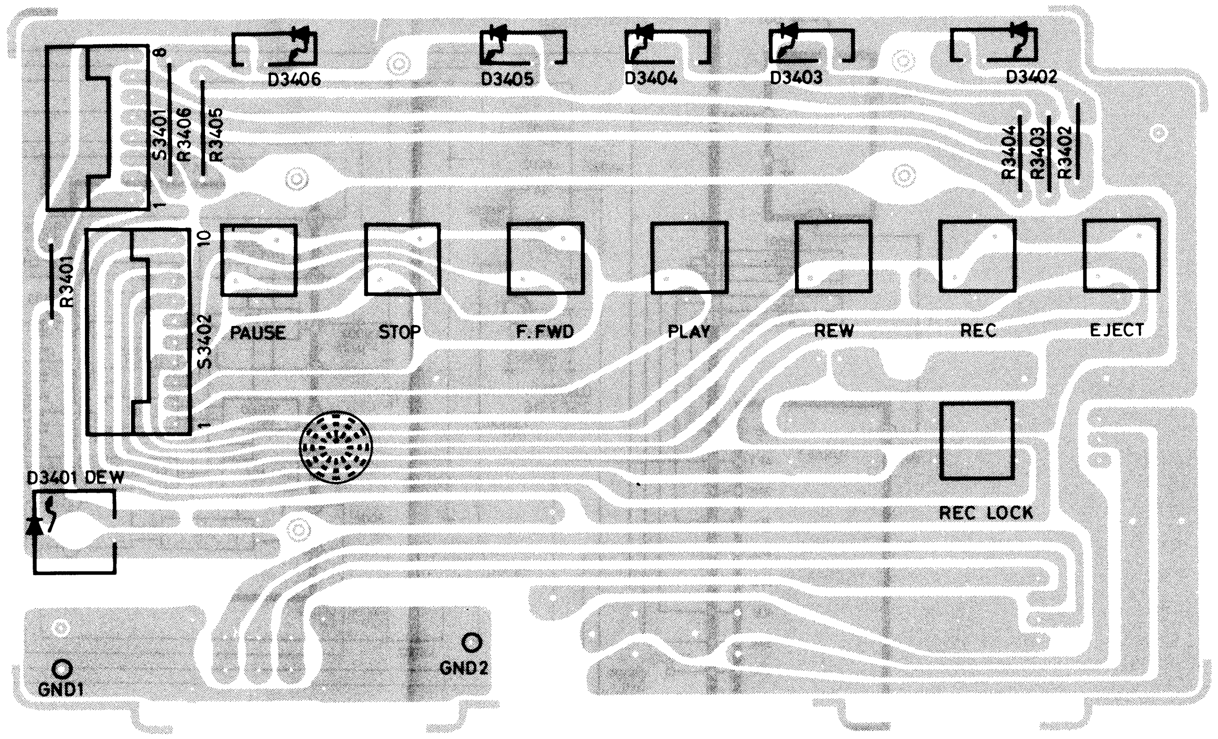
P.C.B. SV-2 CAPSTAN MOTOR CIRCUIT


Q4308 SWITCHING
2SA1115
R4311
2.2K
R4308
2.7K
Q4305~
Q4307
AMP
2SA1115
R4303
33K
Q4304 PD102
R4306
10µ/25
C4305
10µ/25
C4304
10µ/25
Q4301
Q4305
Q4302
Q4306
Q4307
Q4303
R4312
1.2K
R4313
100K
R4304
47K
R4306
47K
R4305
47K
Q4301
~
Q4303
HALL ELEMENT
SENSOR AMP
THREE DIFFER-ENTIAL CIRCUIT
DRIVER
CONTROL AMP
Mc
C4308
0.0047
R4315
3.9K
C4307
22µ/16
D4301
RD5.1EL1
(5.1)
R4301
2.2
C4301
0.0047
C4302
0.047
R4302
220K
C4303
0.047
R4309
4.7K
R4307
47K
R4310
10K
Q4309
SWITCHING
2SC2603
S4301
1 +B
2 GND
3 SERVO
4 FWD/REW
5 FG
6 FG

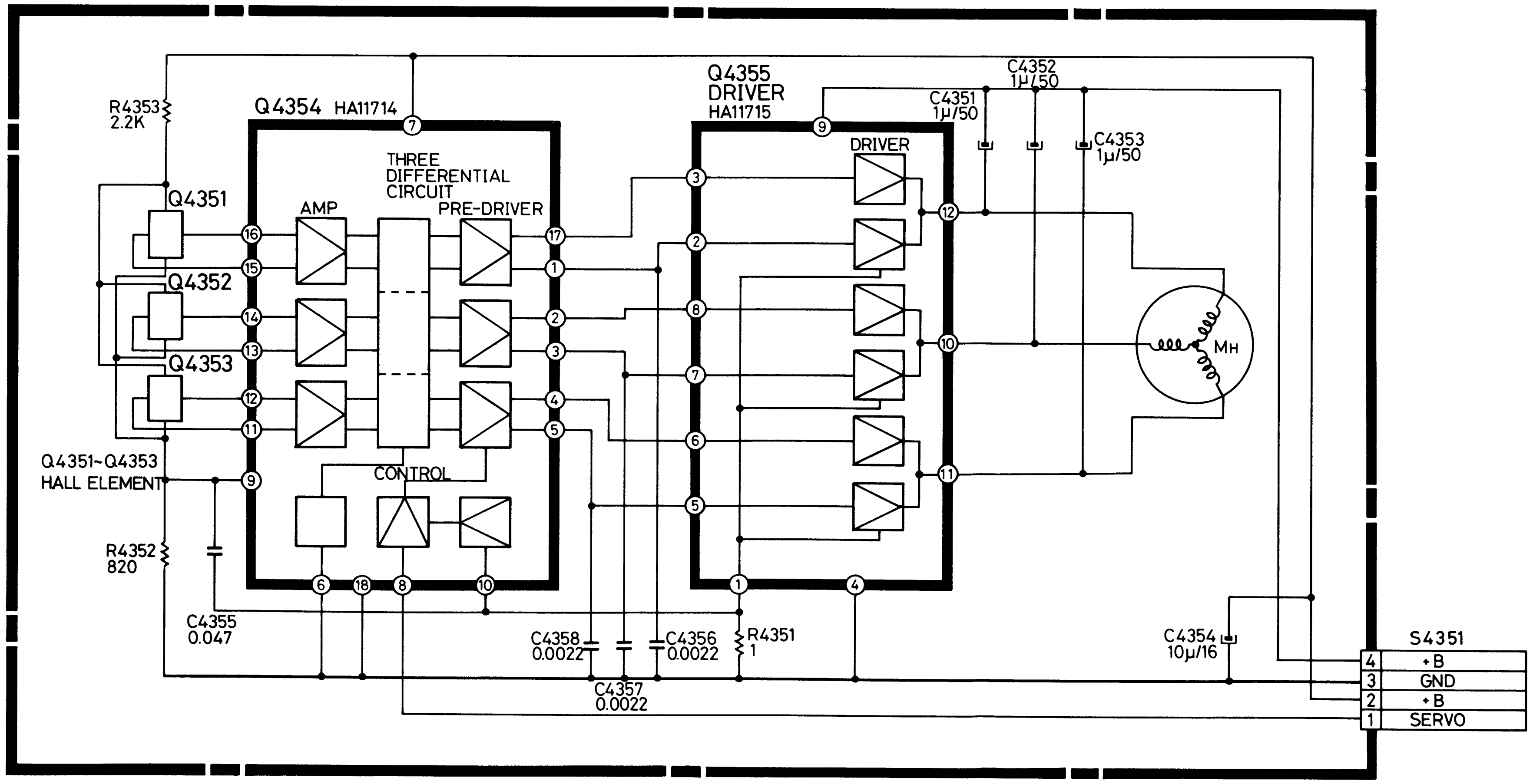
P.C.B. TB-1 TERMINAL CIRCUIT


JW8501
TV LAMP
GND
REG + 12V
VIDEO
GND
AUDIO
GND
O R
B
R
(BL)
GND
(R)
GND
TUNER
EXT IN
SW8501
AUDIO IN
S8501
AUDIO OUT
GND
GND
AUDIO IN
1
2
3
4
VIDEO IN
S8502
GND
VIDEO OUT
TEST + 12V
REG + 12V
VIDEO IN
GND
1
2
3
4
5
6
AUDIO OUT
SW8502
OFF
ON
VIDEO OUT

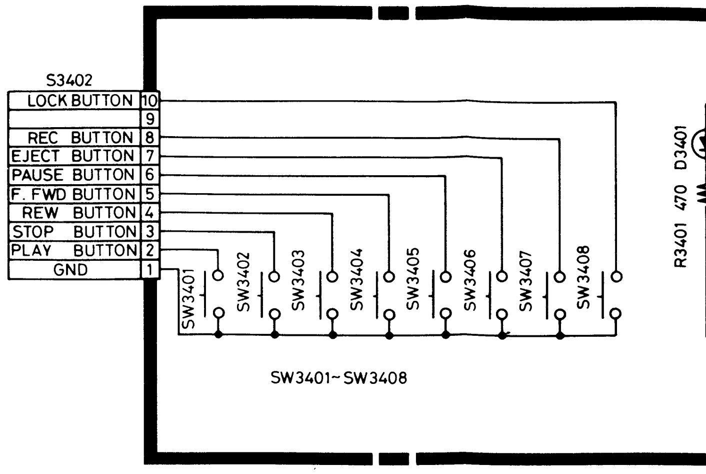
P.C.B. SY-2 OPERATION SWITCH


D3406
D3405
D3404
D3403
D3402
S3401
R3406
R3405
R3404
R3403
R3402
8
1
10
R3401
S3402
1
PAUSE
STOP
F. FWD
PLAY
REW
REC
EJECT
D3401 DEW
REC LOCK
GND1
GND2

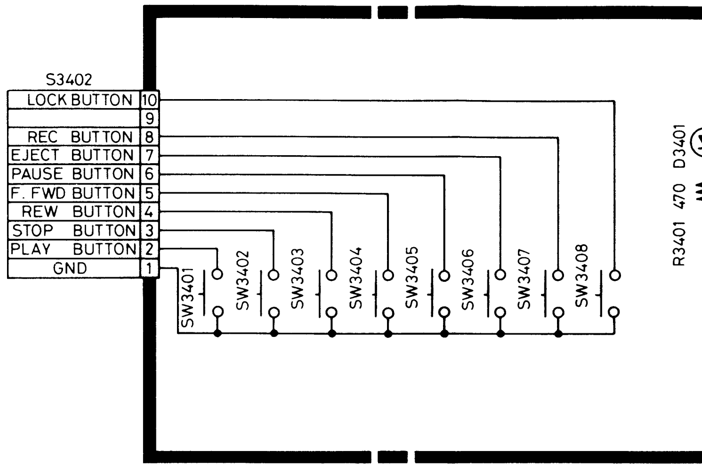
P.C.B. SV-3 HEAD MOTOR CIRCUIT


R4353
2.2K
Q4354 HA11714
7
THREE
DIFFERENTIAL
CIRCUIT
AMP
PRE-DRIVER
Q4351
Q4352
Q4353
16
15
14
13
12
11
17
1
2
3
4
5
9
Q4351~Q4353
HALL ELEMENT
CONTROL
6
18
8
10
R4352
820
C4355
0.047
Q4355
DRIVER
HA11715
9
DRIVER
3
2
8
7
6
5
1
4
12
10
11
C4352
1μ/50
C4351
1μ/50
C4353
1μ/50
MH
C4358
0.0022
C4356
0.0022
C4357
0.0022
R4351
1
C4354
10μ/16
S4351
4
3
2
1
+B
GND
+B
SERVO

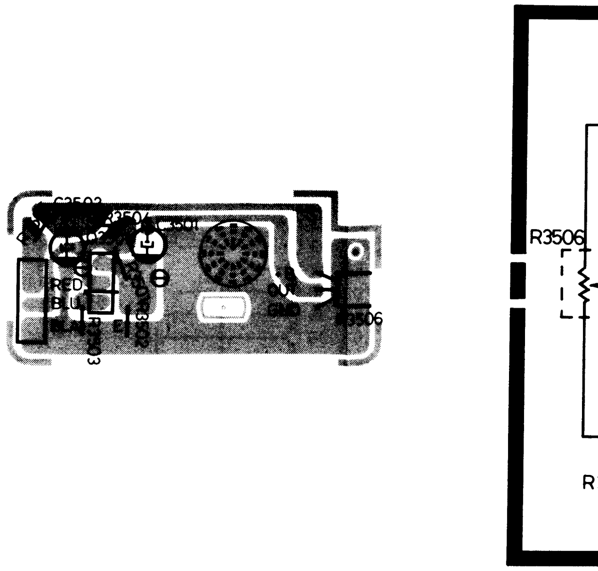
P.C.B. SY-2 OPERATI


S3402
LOCK BUTTON
REC BUTTON
EJECT BUTTON
PAUSE BUTTON
F. FWD BUTTON
REW BUTTON
STOP BUTTON
PLAY BUTTON
GND
10
9
8
7
6
5
4
3
2
1
SW3401
SW3402
SW3403
SW3404
SW3405
SW3406
SW3407
SW3408
SW3401~SW3408
R3401 470
D3401

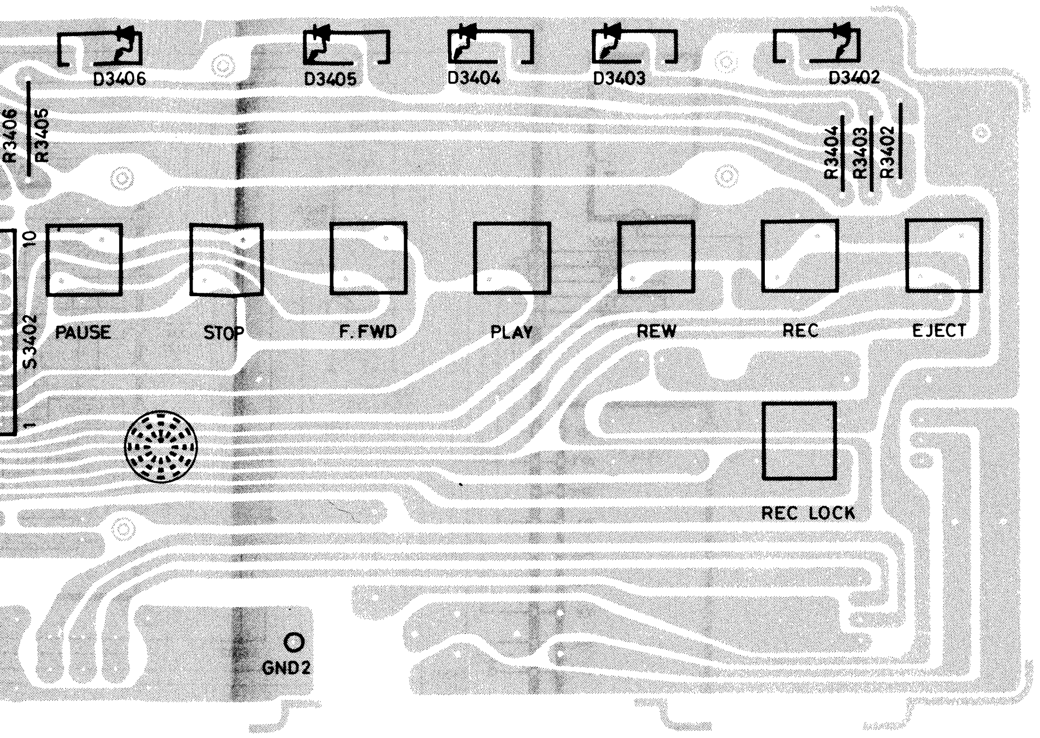
P.C.B. SY-2 OPERATION SWITC


S3402
LOCK BUTTON
REC BUTTON
EJECT BUTTON
PAUSE BUTTON
F. FWD BUTTON
REW BUTTON
STOP BUTTON
PLAY BUTTON
GND
10
9
8
7
6
5
4
3
2
1
SW3401
SW3402
SW3403
SW3404
SW3405
SW3406
SW3407
SW3408
R3401 470
D3401

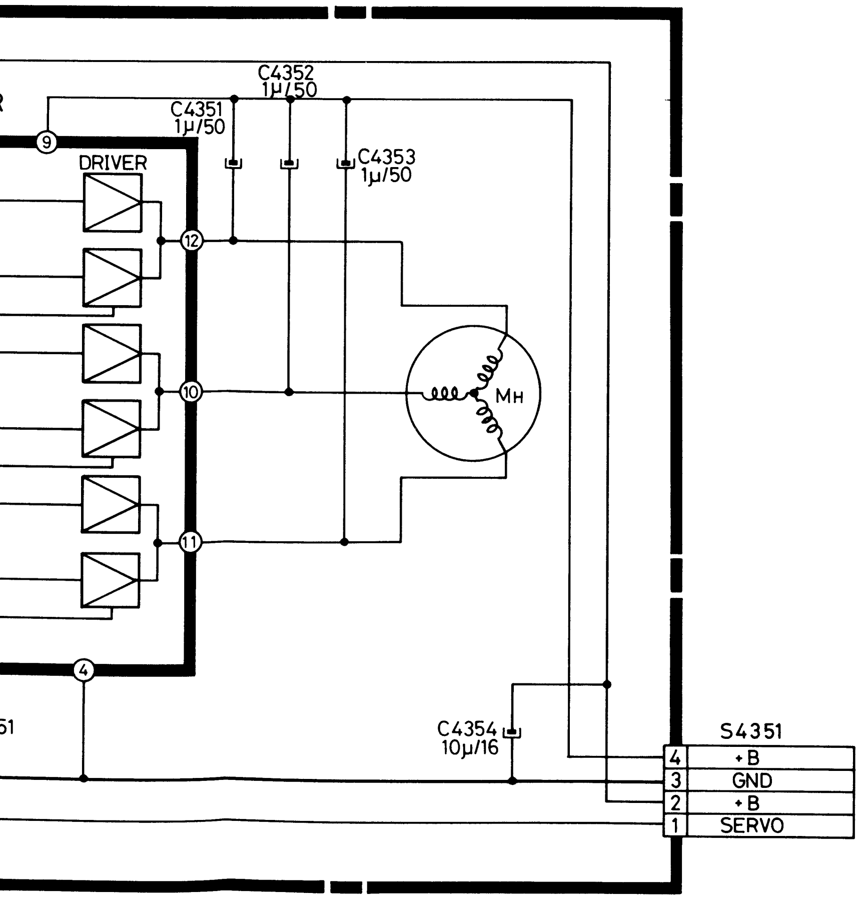
P.C.B. MC-1 REEL SENSOR


C3502
R3504
R3506
R

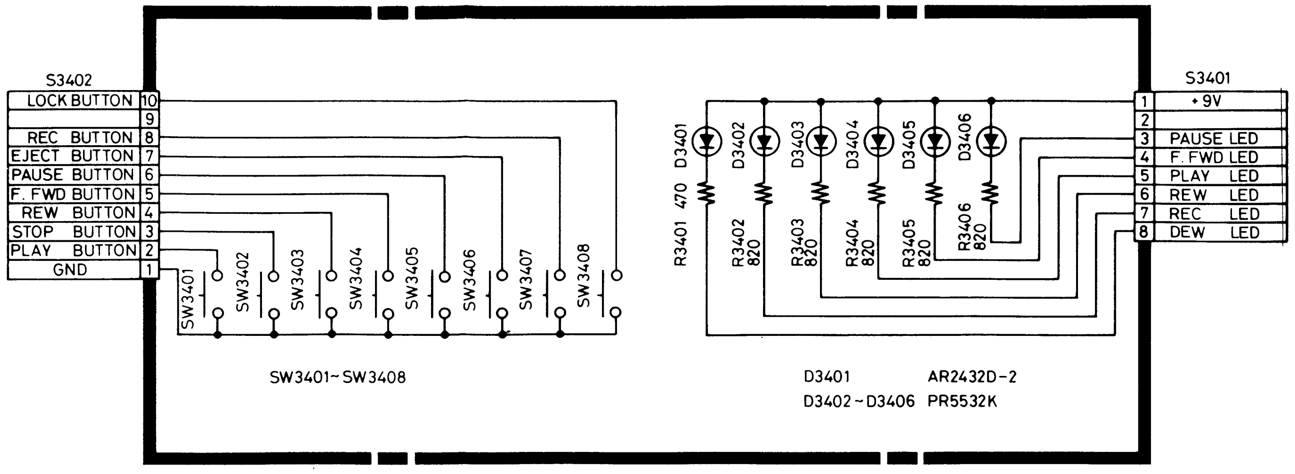
P.C.B. SY-2 OPERATION SWITCH


D3406
D3405
D3404
D3403
D3402
R3406
R3405
R3404
R3403
R3402
10
S3402
1
PAUSE
STOP
F.FWD
PLAY
REW
REC
EJECT
REC LOCK
GND2

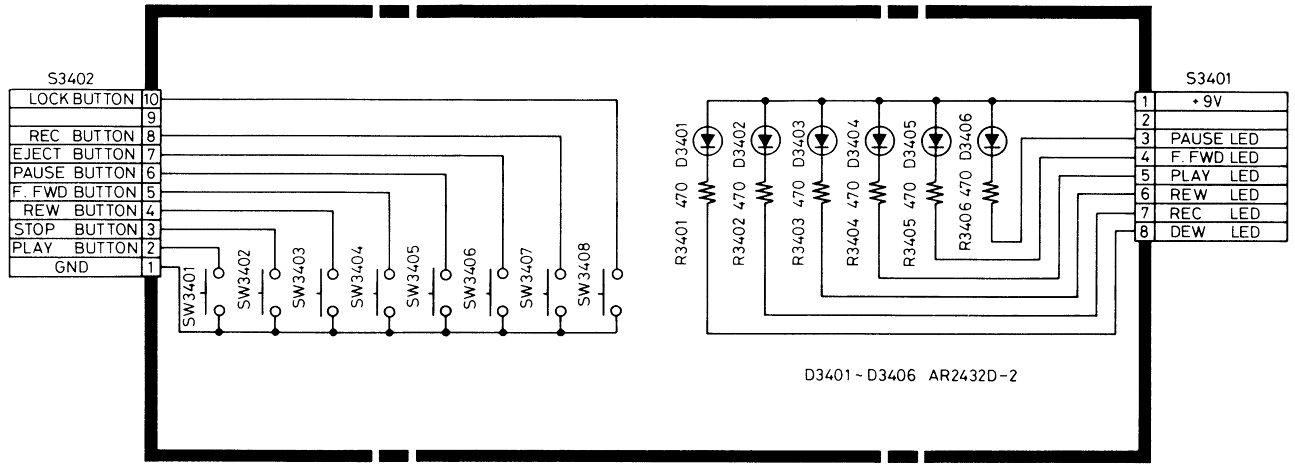
OR CIRCUIT


C4352
1µ/50
C4351
1µ/50
C4353
1µ/50
DRIVER
9
12
10
11
4
MH
51
C4354
10µ/16
S4351
4 +B
3 GND
2 +B
1 SERVO

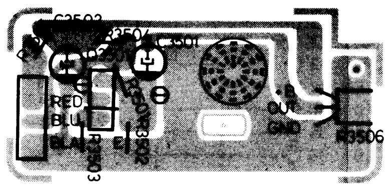
P.C.B. SY-2 OPERATION SWITCH

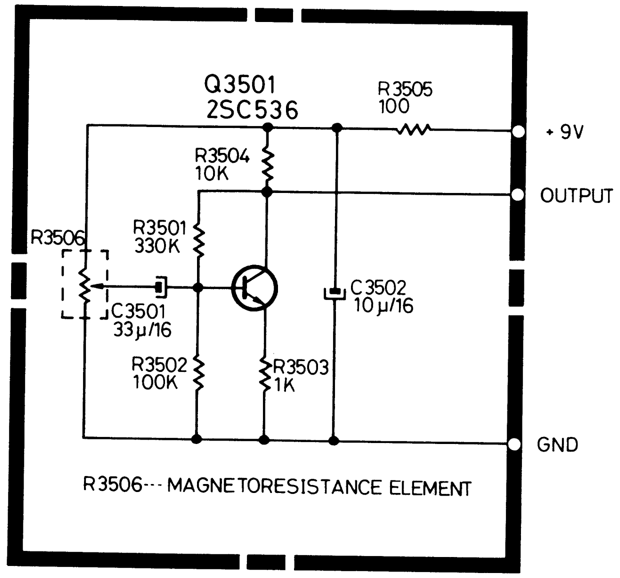

S3402
LOCK BUTTON 10
9
REC BUTTON 8
EJECT BUTTON 7
PAUSE BUTTON 6
F. FWD BUTTON 5
REW BUTTON 4
STOP BUTTON 3
PLAY BUTTON 2
GND 1
SW3401
SW3402
SW3403
SW3404
SW3405
SW3406
SW3407
SW3408
SW3401~SW3408
D3401
D3402
D3403
D3404
D3405
D3406
R3401 470
R3402 820
R3403 820
R3404 820
R3405 820
R3406 820
D3401 AR2432D-2
D3402~D3406 PR5532K
S3401
1 +9V
2
3 PAUSE LED
4 F. FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED

P.C.B. SY-2 OPERATION SWITCH VBS-7500, VBS-7500S VBS-9900, VBS-9900S


S3402
LOCK BUTTON 10
9
REC BUTTON 8
EJECT BUTTON 7
PAUSE BUTTON 6
F. FWD BUTTON 5
REW BUTTON 4
STOP BUTTON 3
PLAY BUTTON 2
GND 1
SW3401
SW3402
SW3403
SW3404
SW3405
SW3406
SW3407
SW3408
D3401
D3402
D3403
D3404
D3405
D3406
R3401 470
R3402 470
R3403 470
R3404 470
R3405 470
R3406 470
D3401~D3406 AR2432D-2
S3401
1 +9V
2
3 PAUSE LED
4 F. FWD LED
5 PLAY LED
6 REW LED
7 REC LED
8 DEW LED

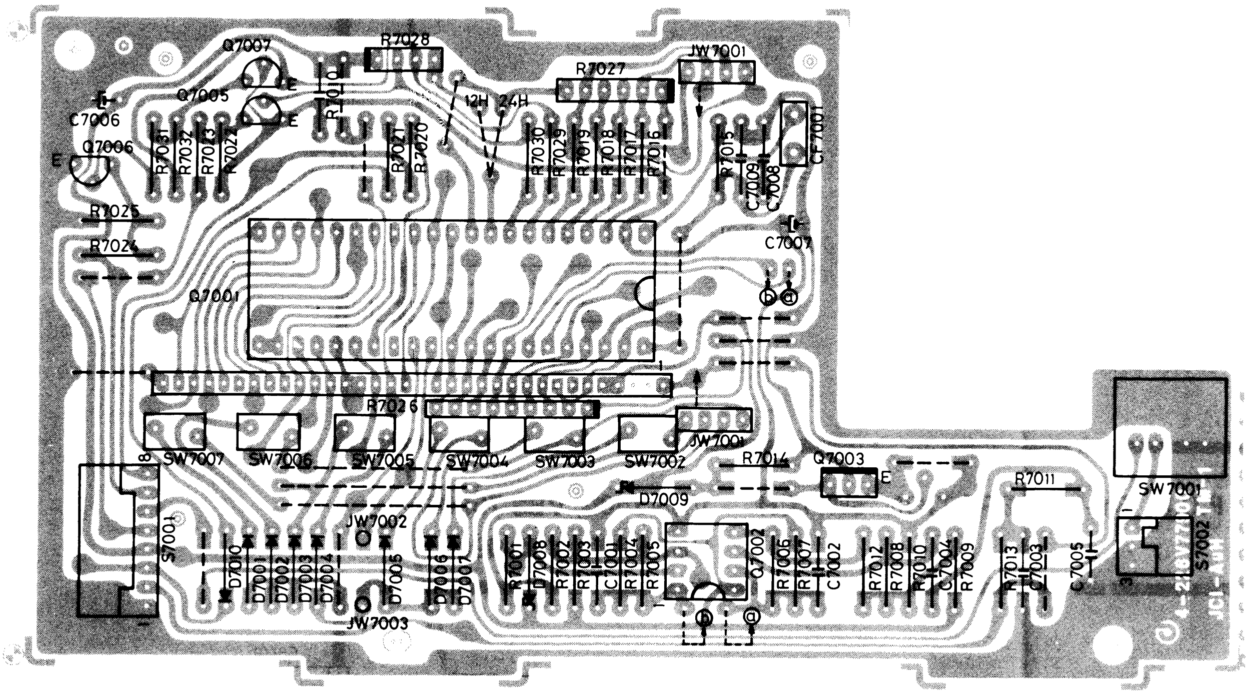
P.C.B. MC-1 REEL SENSOR CIRCUIT


C3502
C3501
RED
BLU
R3503
OUT
GND
R3506

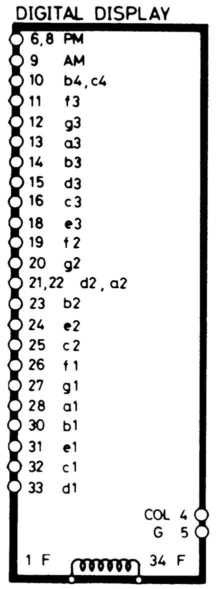

Q3501
2SC536
R3505
100
+9V
R3504
10K
OUTPUT
R3501
330K
R3506
C3501
33µ/16
C3502
10µ/16
R3502
100K
R3503
1K
GND
R3506··· MAGNETORESISTANCE ELEMENT

Ⓖ

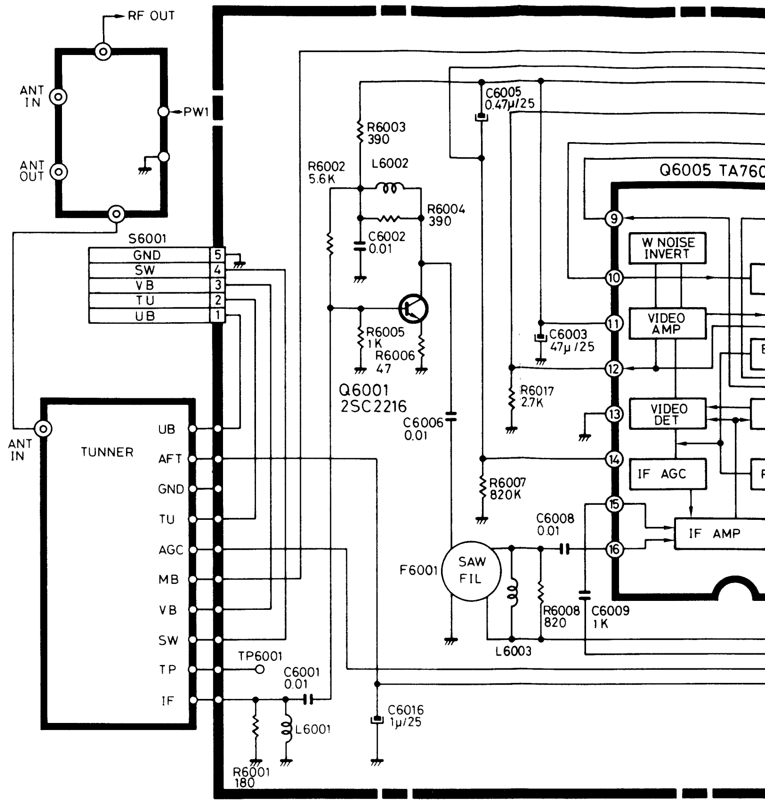
P.C.B. TM-1 TIMER


Q7007
Q7005
C7006
Q7006
R7028
R7027
JW7001
12H
24H
R7031
R7032
R7023
R7024
R7025
R7022
R7021
R7020
R7030
R7029
R7019
R7018
R7017
R7016
R7015
C7009
C7008
CF7001
C7007
Q7001
R7026
SW7007
SW7006
SW7005
SW7004
SW7003
SW7002
JW7001
R7014
Q7003
R7011
SW7001
D7009
JW7002
JW7003
S7001
S7002
D7010
D7001
D7002
D7003
D7004
D7005
D7006
D7007
R7001
R7008
R7002
R7003
C7001
R7004
R7005
Q7002
R7006
R7007
C7002
R7012
R7009
R7010
R7013
C7003
C7005
C7004

P.C.B. TM-1 (Australia New Zealand)

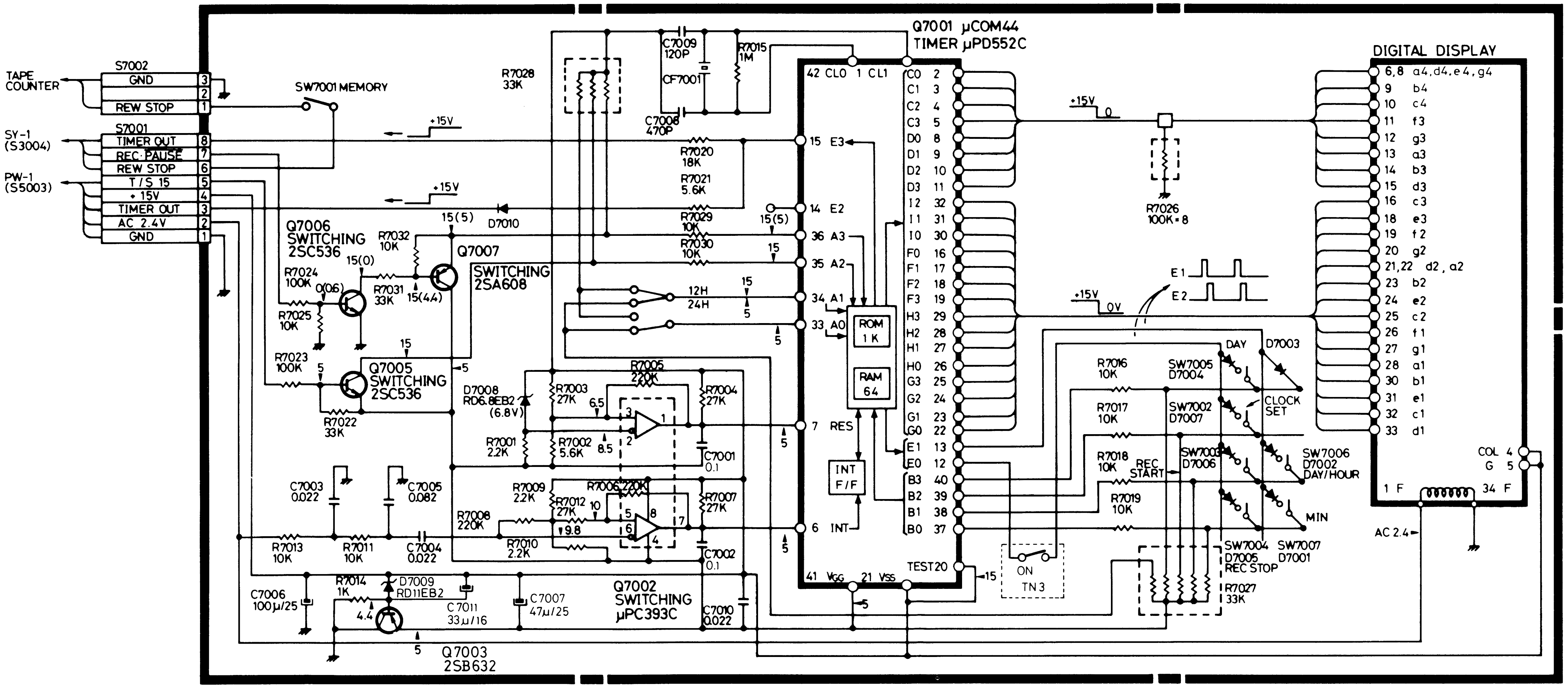

DIGITAL DISPLAY
6,8 PM
9 AM
10 b4, c4
11 f3
12 g3
13 a3
14 b3
15 d3
16 c3
18 e3
19 f2
20 g2
21,22 d2, a2
23 b2
24 e2
25 c2
26 f1
27 g1
28 a1
30 b1
31 e1
32 c1
33 d1
COL 4
G 5
1 F
34 F

P.C.B. TN-1 I.F

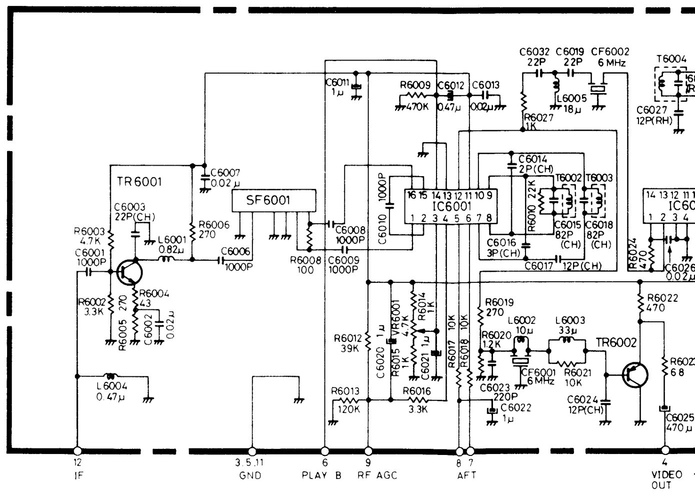

RF OUT
ANT IN
ANT OUT
PW1
S6001
GND
SW
VB
TU
UB
ANT IN
TUNNER
UB
AFT
GND
TU
AGC
MB
VB
SW
TP
IF
TP6001
C6005 0.47μ/25
R6003 390
R6002 5.6K
L6002
C6002 0.01
R6004 390
R6005 1K
R6006 47
Q6001 2SC2216
C6006 0.01
C6003 47μ/25
R6017 27K
R6007 820K
C6008 0.01
SAW FIL
F6001
R6008 820
C6009 1K
L6003
C6001 0.01
C6016 1μ/25
L6001
R6001 180
Q6005 TA760
W NOISE INVERT
VIDEO AMP
VIDEO DET
IF AGC
IF AMP

P.C.B. TM-1 TIMER CIRCUIT

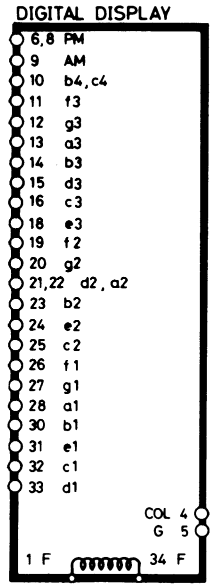
Ⓗ

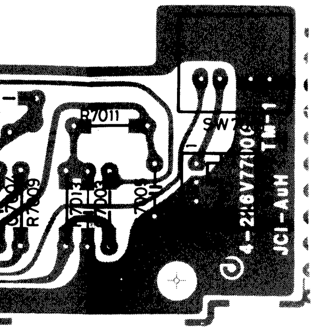

TAPE COUNTER
S7002
GND
REW STOP
SY-1 (S3004)
PW-1 (S5003)
S7001
TIMER OUT
REC PAUSE
REW STOP
T/S 15
+15V
TIMER OUT
AC 2.4V
GND
SW7001 MEMORY
+15V
D7010
Q7006 SWITCHING 2SC536
R7032 10K
Q7007 SWITCHING 2SA608
R7024 100K
R7025 10K
R7031 33K
R7023 100K
Q7005 SWITCHING 2SC536
R7022 33K
R7028 33K
C7009 120P
R7015 1M
CF7001
C7008 470P
R7020 18K
R7021 5.6K
R7029 10K
R7030 10K
12H
24H
D7008 RD6.8EB2 (6.8V)
R7003 27K
R7005 220K
R7004 27K
R7001 2.2K
R7002 5.6K
C7001 0.1
C7003 0.022
C7005 0.082
R7009 2.2K
R7006 220K
R7012 27K
R7007 27K
R7008 220K
R7010 2.2K
R7013 10K
R7011 10K
C7004 0.022
C7002 0.1
C7006 100μ/25
R7014 1K
D7009 RD11EB2
C7011 33μ/16
C7007 47μ/25
Q7002 SWITCHING μPC393C
C7010 0.022
Q7003 2SB632
Q7001 μCOM44 TIMER μPD552C
42 CL0
1 CL1
15 E3
14 E2
36 A3
35 A2
34 A1
33 A0
7 RES
6 INT
41 VGG
21 VSS
TEST 20
ROM 1K
RAM 64
INT F/F
C0 C1 C2 C3 D0 D1 D2 D3 I2 I1 I0 F0 F1 F2 F3 H3 H2 H1 H0 G3 G2 G1 G0 E1 E0 B3 B2 B1 B0
+15V
0V
R7026 100K×8
E1
E2
DAY
D7003
R7016 10K
SW7005 D7004
R7017 10K
SW7002 D7007
CLOCK SET
R7018 10K
SW7003 D7006
REC START
SW7006 D7002 DAY/HOUR
R7019 10K
MIN
SW7004 D7005 REC STOP
SW7007 D7001
R7027 33K
ON
TN3
DIGITAL DISPLAY
6,8 a4, d4, e4, g4
9 b4
10 c4
11 f3
12 g3
13 a3
14 b3
15 d3
16 c3
18 e3
19 f2
20 g2
21,22 d2, a2
23 b2
24 e2
25 c2
26 f1
27 g1
28 a1
30 b1
31 e1
32 c1
33 d1
COL 4
G 5
1 F
34 F
AC 2.4

P.C.B. TN-1 (Ireland)

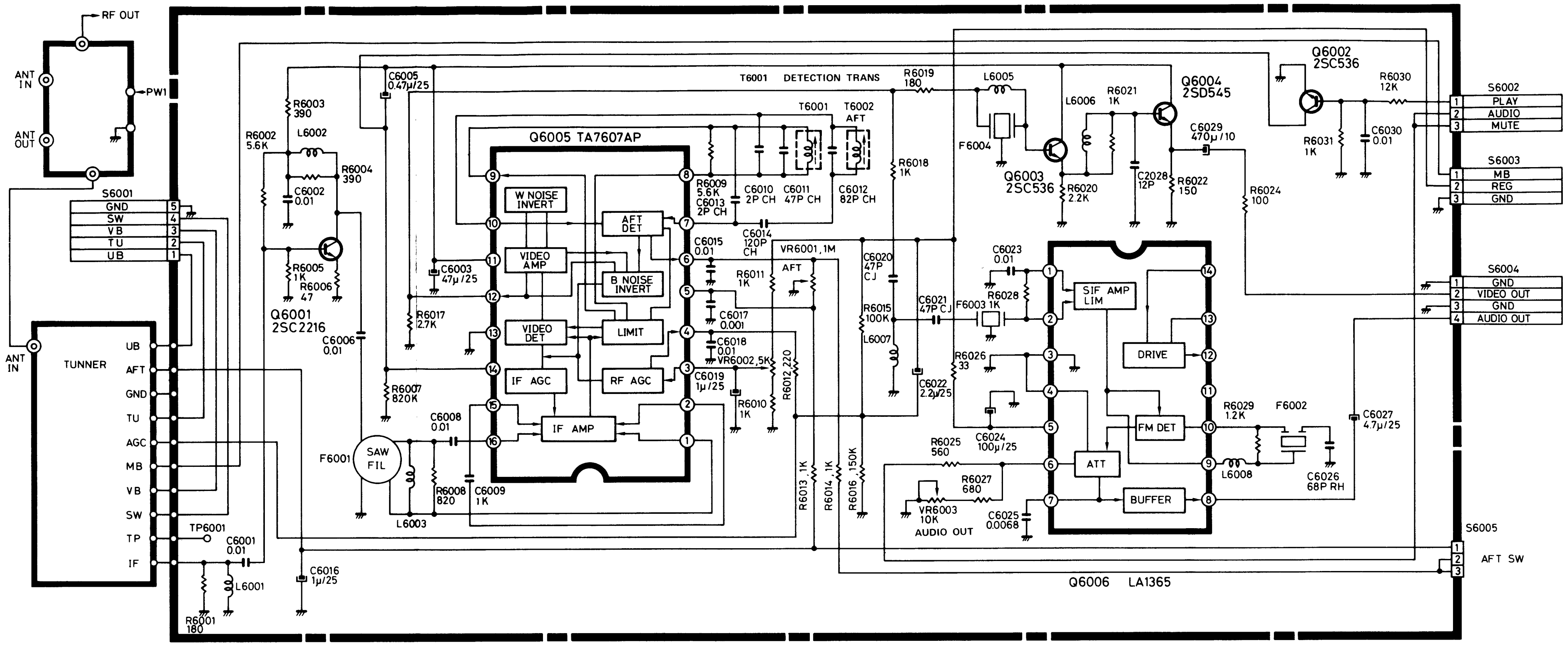

TR6001
SF6001
IC6001
TR6002
12 IF
3 5 11 GND
6 PLAY B
9 RF AGC
8 7 AFT
4 VIDEO OUT

P.C.B. TM-1 (Australia
New Zealand)

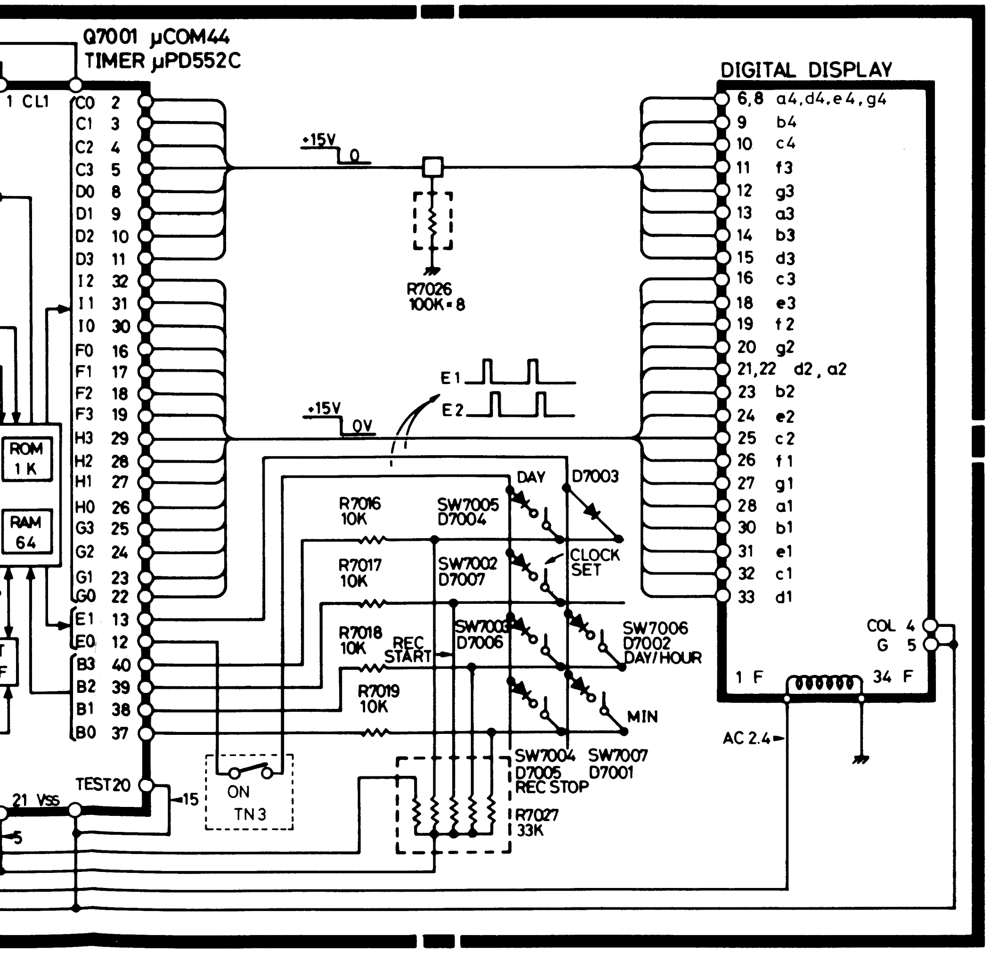

DIGITAL DISPLAY
6,8 PM
9 AM
10 b4,c4
11 f3
12 g3
13 a3
14 b3
15 d3
16 c3
18 e3
19 f2
20 g2
21,22 d2, a2
23 b2
24 e2
25 c2
26 f1
27 g1
28 a1
30 b1
31 e1
32 c1
33 d1
COL 4
G 5
1 F
34 F


R7011
JCI-AuH TM-1

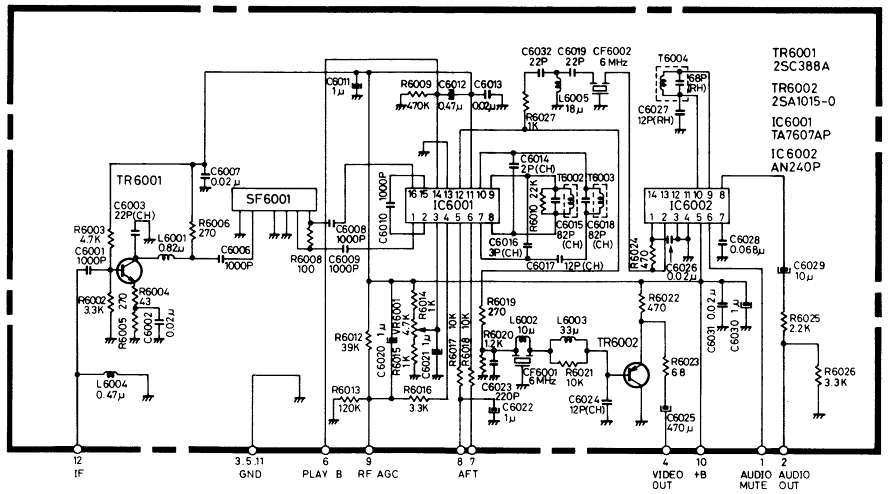
P.C.B. TN-1 I.F CIRCUIT


RF OUT
ANT IN
ANT OUT
PW1
S6001
GND
SW
VB
TU
UB
TUNNER
UB
AFT
GND
TU
AGC
MB
VB
SW
TP
IF
TP6001
C6001 0.01
L6001
R6001 180
C6016 1μ/25
Q6001 2SC2216
R6002 5.6K
R6003 390
L6002
R6004 390
C6002 0.01
R6005 1K
R6006 47
C6005 0.47μ/25
C6006 0.01
R6007 820K
F6001
SAW FIL
C6008 0.01
R6008 820
C6009 1K
L6003
Q6005 TA7607AP
W NOISE INVERT
VIDEO AMP
VIDEO DET
IF AGC
IF AMP
AFT DET
B NOISE INVERT
LIMIT
RF AGC
C6003 47μ/25
R6017 2.7K
T6001 DETECTION TRANS
T6001
T6002 AFT
R6009 5.6K
R6013 2P CH
C6010 2P CH
C6011 47P CH
C6012 82P CH
C6014 120P CH
C6015 0.01
R6011 1K
C6017 0.001
C6018 0.01
VR6002,5K
C6019 1μ/25
R6010 1K
VR6001,1M AFT
R6012,220
R6013 1K
R6014 1K
R6016 150K
R6015 100K
L6007
R6018 1K
R6019 180
C6020 47P CJ
C6021 47P CJ
F6003
C6022 2.2μ/25
L6005
F6004
L6006
Q6003 2SC536
R6020 2.2K
R6021 1K
Q6004 2SD545
C2028 12P
R6022 150
C6029 470μ/10
C6023 0.01
R6028 1K
R6026 33
C6024 100μ/25
R6025 560
R6027 680
VR6003 10K AUDIO OUT
C6025 0.0068
SIF AMP LIM
DRIVE
FM DET
ATT
BUFFER
Q6006 LA1365
R6024 100
R6029 1.2K
F6002
L6008
C6026 68P RH
C6027 4.7μ/25
Q6002 2SC536
R6030 12K
R6031 1K
C6030 0.01
S6002
PLAY
AUDIO
MUTE
S6003
MB
REG
GND
S6004
GND
VIDEO OUT
GND
AUDIO OUT
S6005
AFT SW

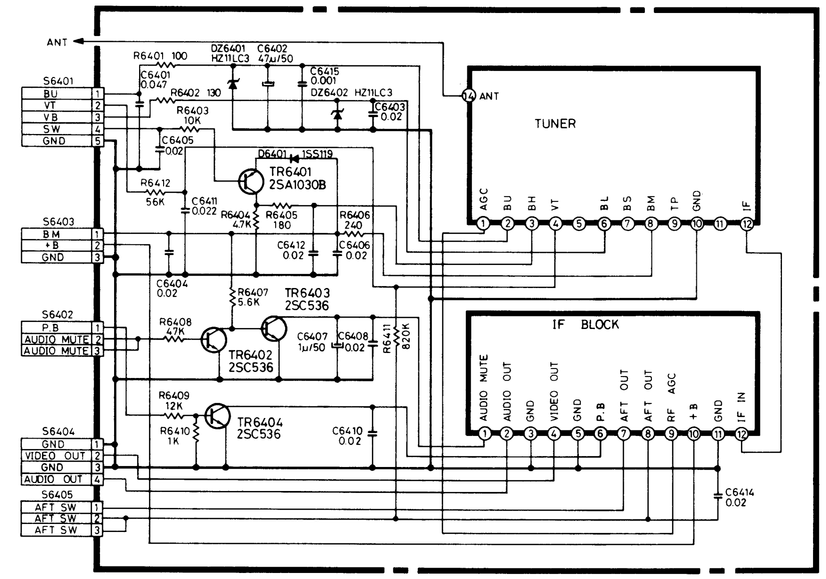
IMER CIRCUIT


Q7001 μCOM44
TIMER μPD552C
CL1
ROM 1K
RAM 64
C0 C1 C2 C3 D0 D1 D2 D3 I2 I1 I0 F0 F1 F2 H3 H2 H1 H0 G3 G2 G1 G0 E1 E0 B3 B2 B1 B0
TEST 20
21 VSS
+15V
0
R7026 100K×8
+15V 0V
E1
E2
R7016 10K
R7017 10K
R7018 10K
R7019 10K
SW7005 D7004
SW7002 D7007
SW7003 D7006
SW7004 D7005
SW7007 D7001
DAY
D7003
CLOCK SET
REC START
SW7006 D7002 DAY/HOUR
MIN
REC STOP
R7027 33K
ON
TN3
-15
DIGITAL DISPLAY
6,8 a4,d4,e4,g4
9 b4
10 c4
11 f3
12 g3
13 a3
14 b3
15 d3
16 c3
18 e3
19 f2
20 g2
21,22 d2, a2
23 b2
24 e2
25 c2
26 f1
27 g1
28 a1
30 b1
31 e1
32 c1
33 d1
COL 4
G 5
1 F
34 F
AC 2.4

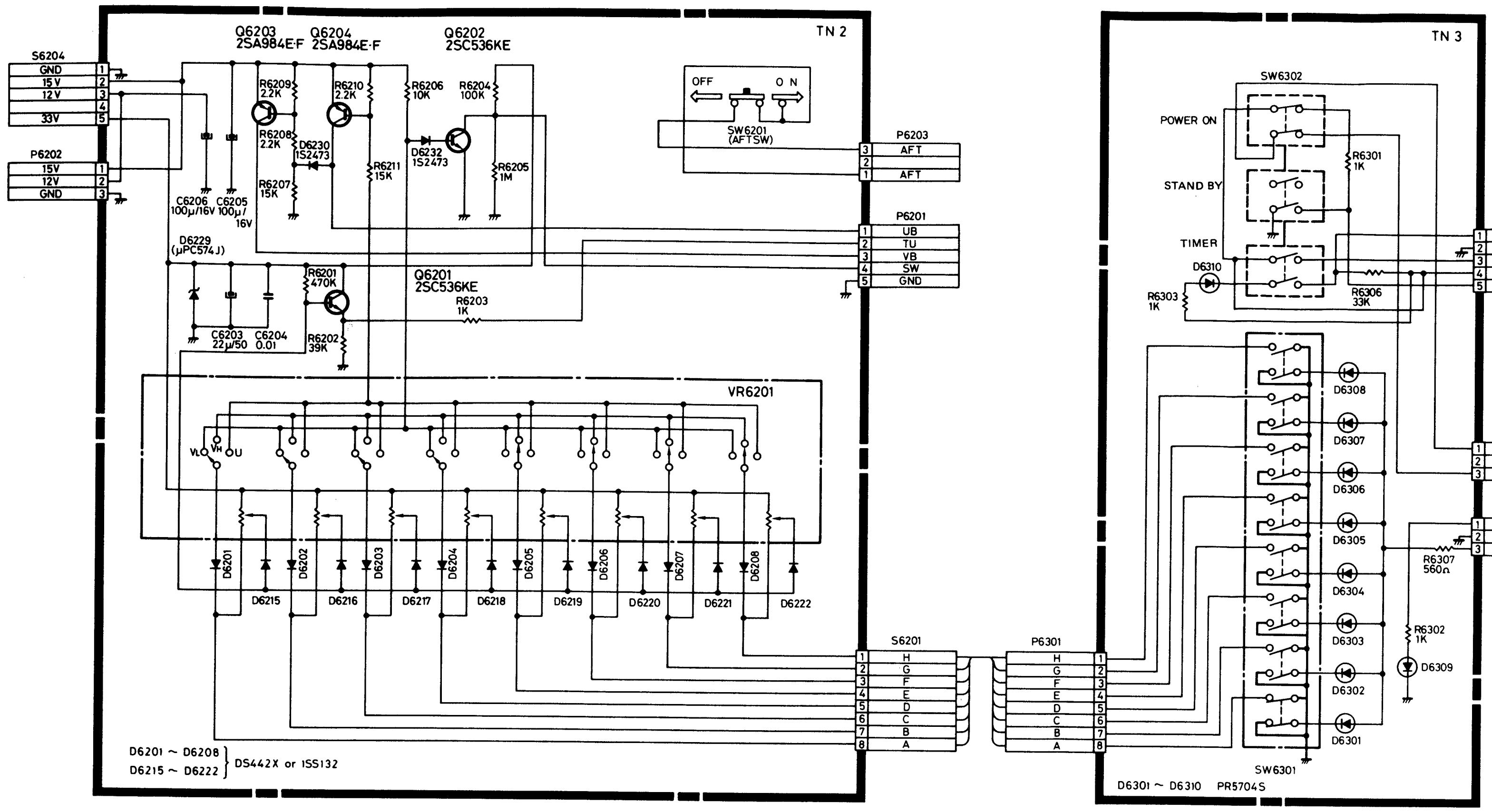
P.C.B. TN-1 (Ireland)


TR6001 2SC388A
TR6002 2SA1015-O
IC6001 TA7607AP
IC6002 AN240P
SF6001
IC6001
IC6002
TR6001
TR6002
CF6002 6MHz
T6004
T6002
T6003
12 IF
3,5,11 GND
6 PLAY B
9 RF AGC
8 7 AFT
4 VIDEO OUT
10 +B
1 AUDIO MUTE
2 AUDIO OUT

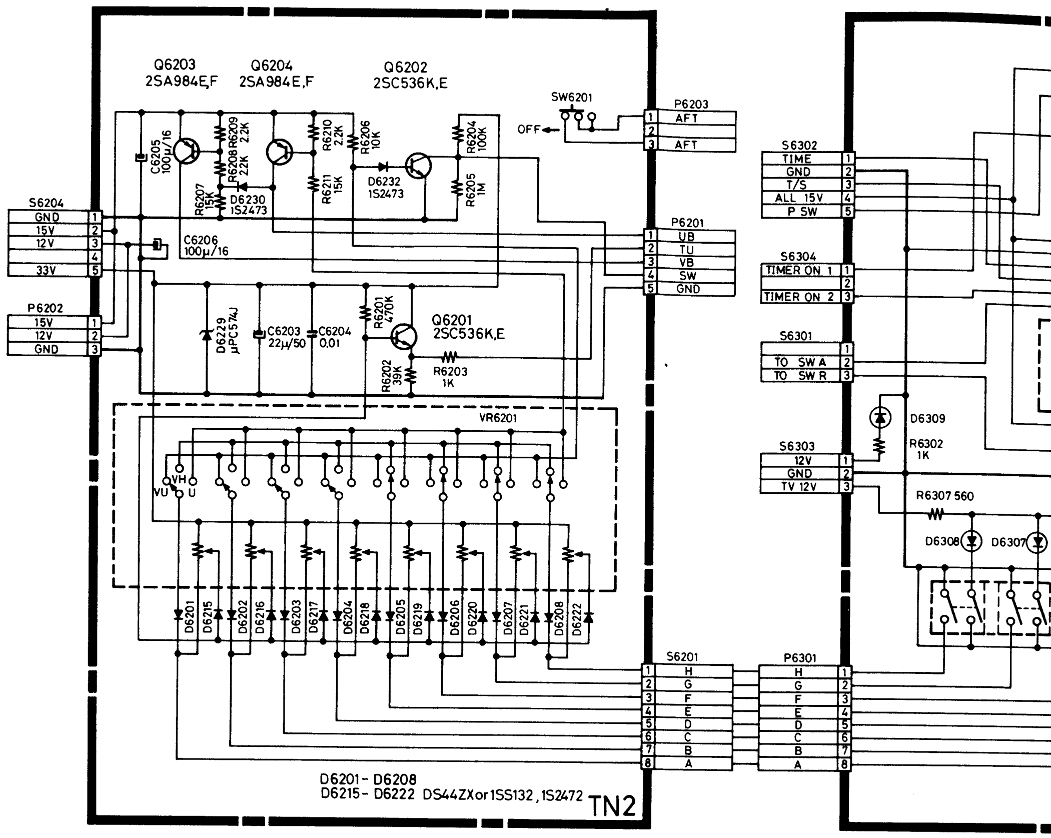
P.C.B. TN-4 (Ireland)


ANT
S6401
BU
VT
VB
SW
GND
S6403
BM
+B
GND
S6402
P.B
AUDIO MUTE
AUDIO MUTE
S6404
VIDEO OUT
GND
AUDIO OUT
S6405
AFT SW
AFT SW
AFT SW
TUNER
AGC
BU
BH
VT
BL
BS
BM
TP
GND
IF
IF BLOCK
AUDIO MUTE
AUDIO OUT
GND
VIDEO OUT
GND
P.B
AFT OUT
RF AGC
+B
GND
IF IN
TR6401 2SA1030B
TR6402 2SC536
TR6403 2SC536
TR6404 2SC536
D6401 1SS119
DZ6401 HZ11LC3
DZ6402 HZ11LC3
C6414 0.02

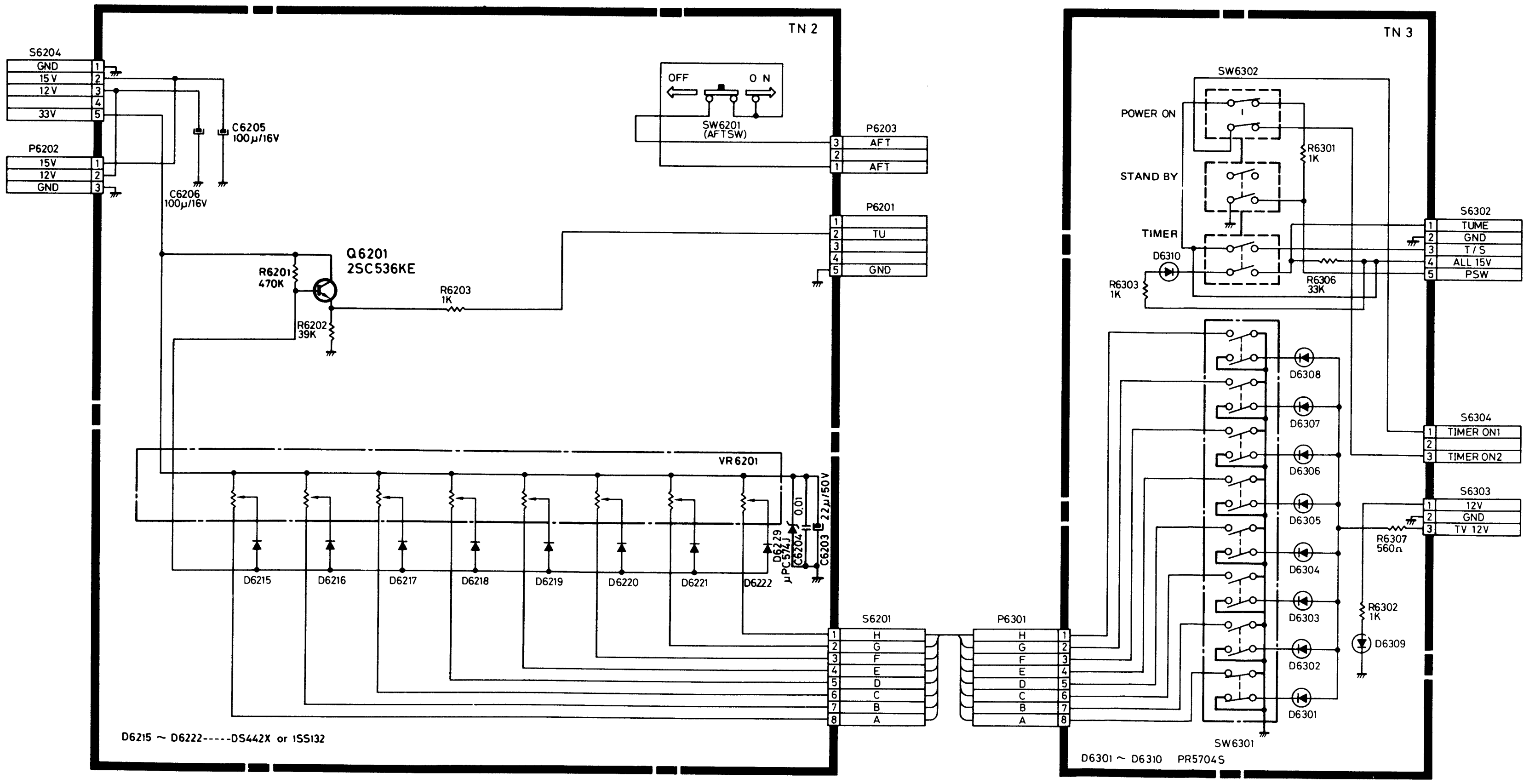
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT


TN 2
TN 3
S6204
GND
15V
12V
33V
P6202
Q6203 2SA984E·F
Q6204 2SA984E·F
Q6202 2SC536KE
Q6201 2SC536KE
R6209 2.2K
R6210 2.2K
R6206 10K
R6204 100K
R6205 1M
R6208 2.2K
R6207 15K
R6211 15K
D6230 1S2473
D6232 1S2473
C6206 100μ/16V
C6205 100μ/16V
D6229 (μPC574J)
R6201 470K
R6203 1K
R6202 39K
C6203 22μ/50
C6204 0.01
VR6201
SW6201 (AFTSW)
OFF
ON
P6203
AFT
P6201
UB
TU
VB
SW
S6201
P6301
SW6302
POWER ON
STAND BY
TIMER
D6310
R6303 1K
R6301 1K
R6306 33K
S6302
TUME
T/S
ALL 15V
PSW
S6304
TIMER ON1
TIMER ON2
S6303
TV 12V
R6307 560Ω
R6302 1K
D6309
D6301 ~ D6308
SW6301
D6201 ~ D6208
D6215 ~ D6222
DS442X or 1SS132
D6301 ~ D6310 PR5704S

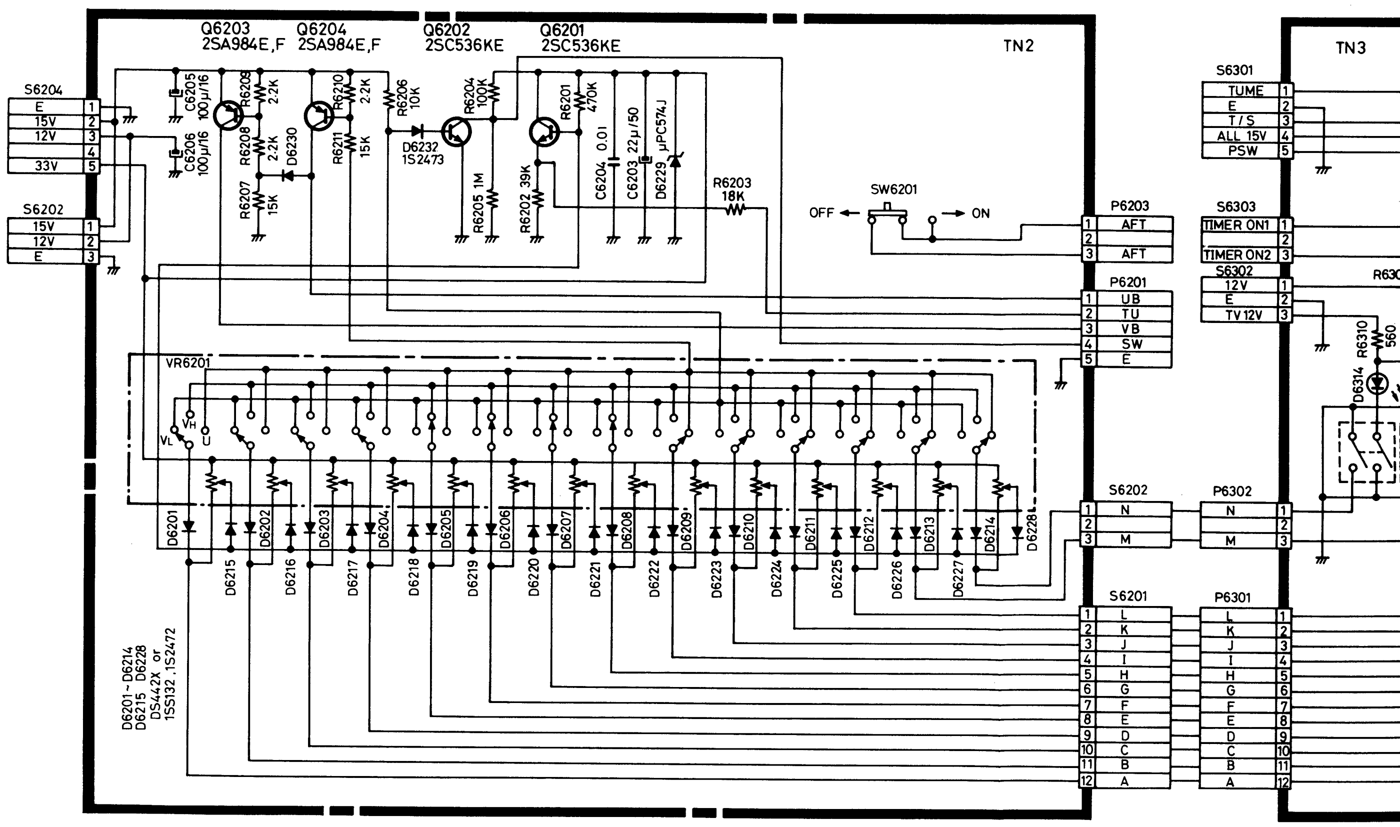
P.C.B. TN-2.3 CHANNEL PRE-SET/SEL
(Australia, New Zealand)


Q6203 2SA984E,F
Q6204 2SA984E,F
Q6202 2SC536K,E
Q6201 2SC536K,E
SW6201
OFF
P6203
AFT
S6204
GND
15V
12V
33V
P6202
C6205 100μ/16
C6206 100μ/16
D6230 1S2473
D6232 1S2473
D6229 μPC574J
C6203 22μ/50
C6204 0.01
R6201 470K
R6202 39K
R6203 1K
P6201
UB
TU
VB
SW
VR6201
S6201
P6301
S6302
TIME
T/S
ALL 15V
P SW
S6304
TIMER ON 1
TIMER ON 2
S6301
TO SW A
TO SW R
S6303
TV 12V
D6309
R6302 1K
R6307 560
D6308
D6307
D6201 - D6208
D6215 - D6222 DS44ZX or 1SS132, 1S2472
TN2

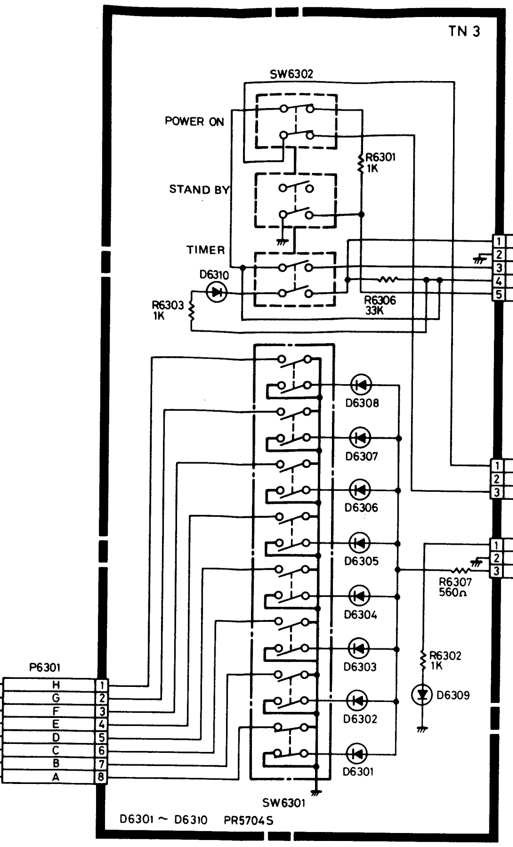
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT
(U·K, H·K)


TN 2
TN 3
S6204
GND
15V
12V
33V
P6202
C6205 100μ/16V
C6206 100μ/16V
SW6201 (AFTSW)
OFF
ON
P6203
AFT
P6201
TU
GND
Q6201 2SC536KE
R6201 470K
R6202 39K
R6203 1K
VR6201
D6229 μPC574J
C6204 0.01
C6203 22μ/50V
D6215 ~ D6222
S6201
P6301
SW6302
POWER ON
STAND BY
TIMER
D6310
R6303 1K
R6301 1K
R6306 33K
S6302
TUME
T/S
ALL 15V
PSW
S6304
TIMER ON1
TIMER ON2
S6303
TV 12V
R6307 560Ω
R6302 1K
D6309
SW6301
D6215 ~ D6222-----DS442X or 1SS132
D6301 ~ D6310 PR5704S

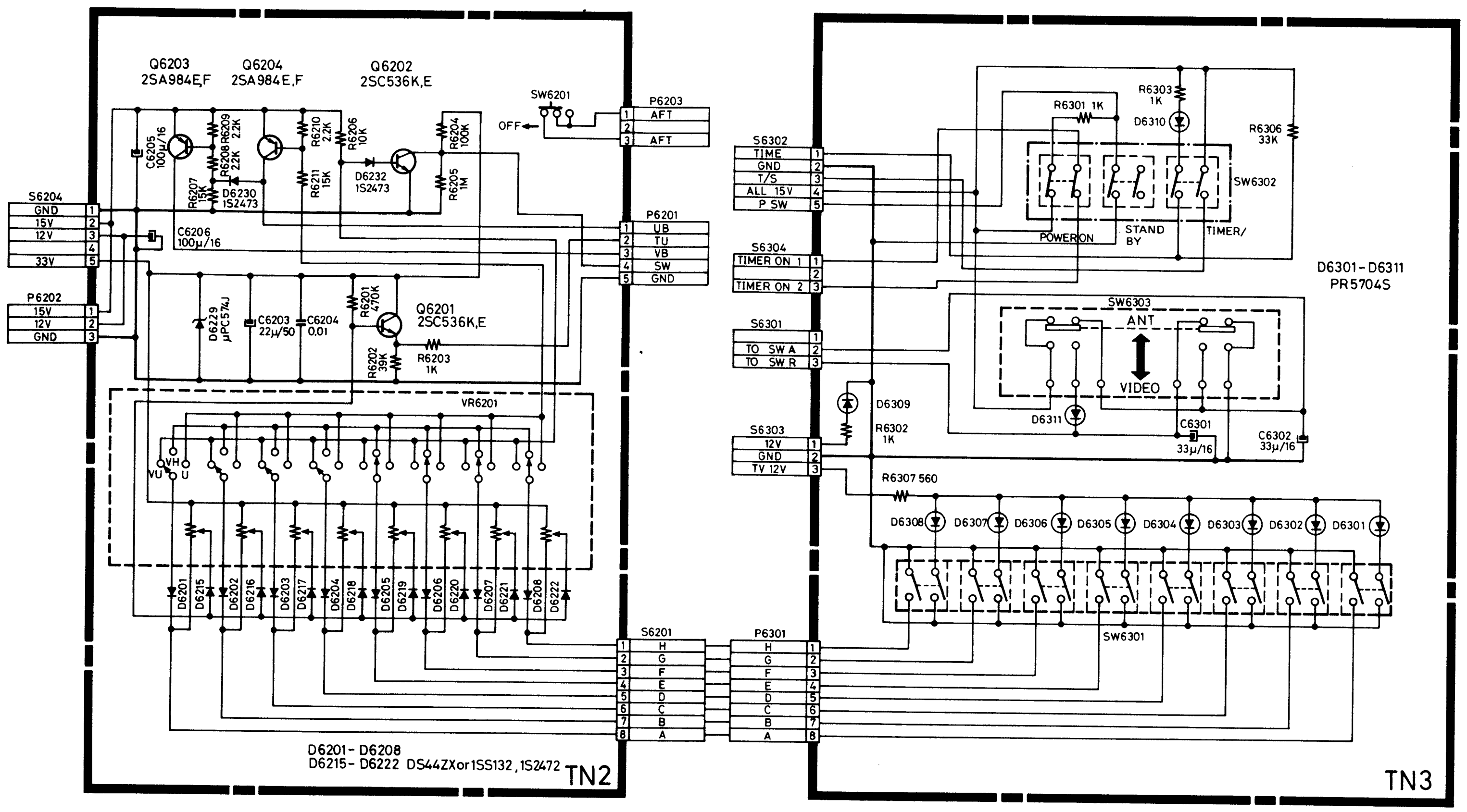
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT
(VBS-7500S, VBS-9900S, 12CH/V


Q6203 2SA984E,F
Q6204 2SA984E,F
Q6202 2SC536KE
Q6201 2SC536KE
TN2
TN3
S6204
S6202
C6205 100μ/16
C6206 100μ/16
R6208 2.2K
R6209 2.2K
R6210 2.2K
R6211 15K
R6206 10K
R6204 100K
R6201 470K
R6207 15K
D6230
D6232 1S2473
R6205 1M
R6202 39K
C6204 0.01
C6203 22μ/50
D6229 μPC574J
R6203 18K
SW6201
OFF
ON
P6203
AFT
P6201
UB
TU
VB
SW
VR6201
S6202
P6302
S6201
P6301
S6301
TUME
T/S
ALL 15V
PSW
S6303
TIMER ON1
TIMER ON2
S6302
TV 12V
R6310 560
D6314
D6201 - D6214
D6215 - D6228
DS442X or
1SS132, 1S2472

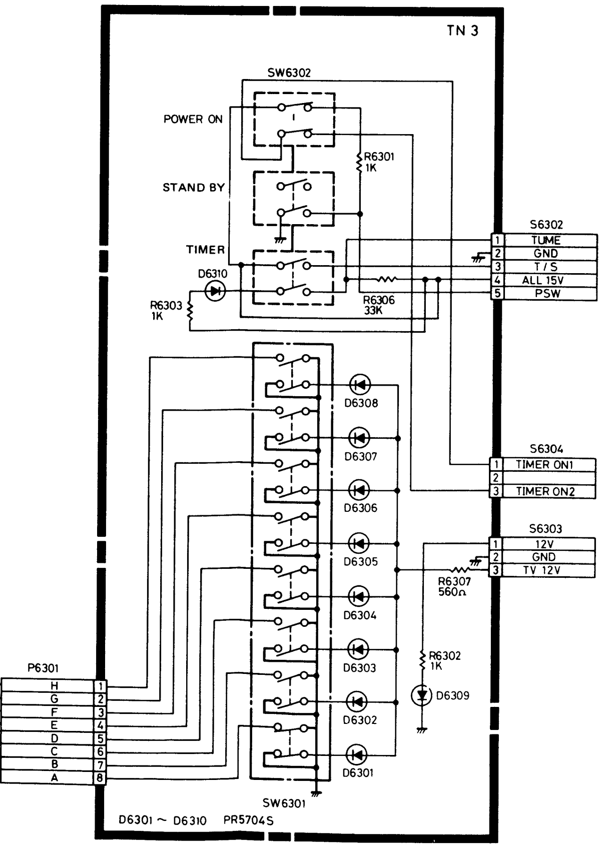
ELECT


TN 3
SW6302
POWER ON
STAND BY
TIMER
D6310
R6301 1K
R6303 1K
R6306 33K
S6302
TUME
GND
T/S
ALL 15V
PSW
D6308
D6307
D6306
D6305
D6304
D6303
D6302
D6301
S6304
TIMER ON1
TIMER ON2
S6303
12V
GND
TV 12V
R6307 560Ω
R6302 1K
D6309
P6301
H
G
F
E
D
C
B
A
SW6301
D6301 ~ D6310 PR5704S

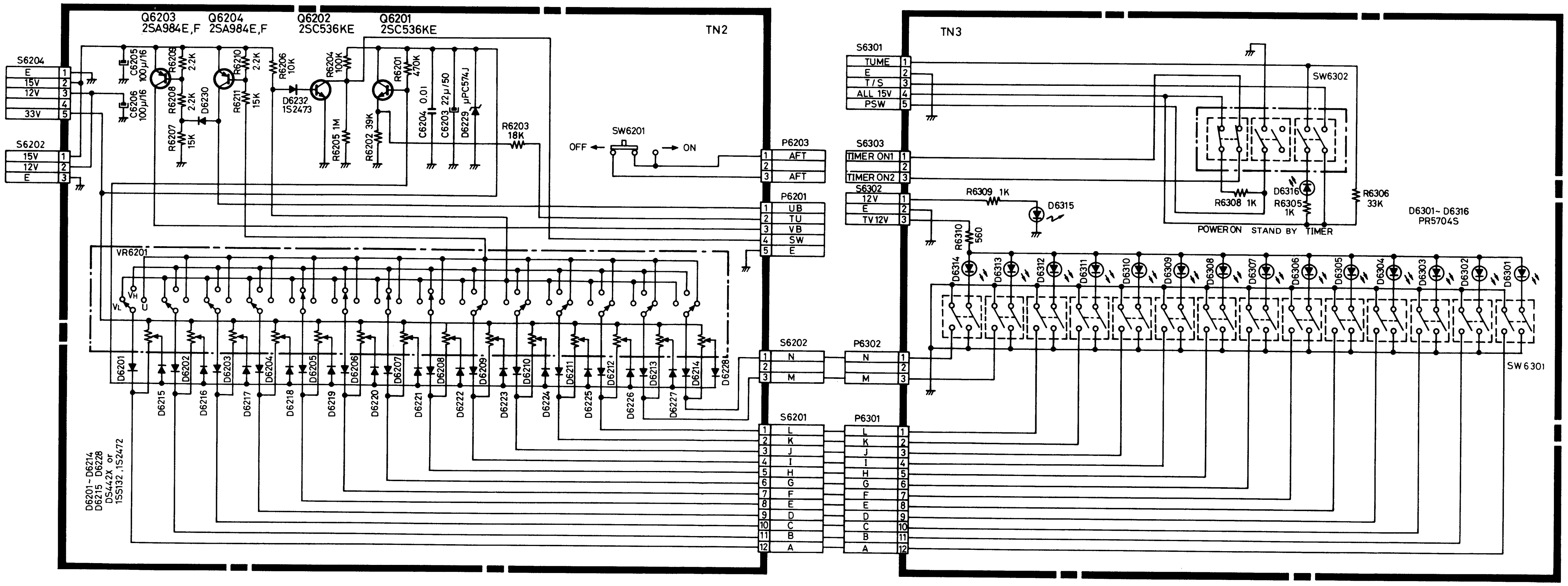
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT
(Australia, New Zealand)


Q6203 2SA984E,F
Q6204 2SA984E,F
Q6202 2SC536K,E
SW6201
OFF
P6203
AFT
AFT
C6205 100μ/16
R6209 2.2K
R6208 2.2K
R6210 22K
R6206 10K
R6204 100K
R6207 15K
D6230 1S2473
R6211 15K
D6232 1S2473
R6205 1M
S6204
GND
15V
12V
33V
C6206 100μ/16
P6201
UB
TU
VB
SW
GND
P6202
15V
12V
GND
D6229 μPC574J
C6203 22μ/50
C6204 0.01
R6201 470K
Q6201 2SC536K,E
R6202 39K
R6203 1K
VR6201
VH
VU
U
D6201
D6215
D6202
D6216
D6203
D6217
D6204
D6218
D6205
D6219
D6206
D6220
D6207
D6221
D6208
D6222
S6201
H
G
F
E
D
C
B
A
D6201- D6208
D6215- D6222 DS442X or 1SS132, 1S2472
TN2
S6302
TIME
GND
T/S
ALL 15V
P SW
S6304
TIMER ON 1
TIMER ON 2
S6301
TO SW A
TO SW R
S6303
12V
GND
TV 12V
R6301 1K
R6303 1K
D6310
R6306 33K
SW6302
POWER ON
STAND BY
TIMER/
D6301- D6311 PR5704S
SW6303
ANT
VIDEO
D6311
C6301 33μ/16
C6302 33μ/16
D6309
R6302 1K
R6307 560
D6308
D6307
D6306
D6305
D6304
D6303
D6302
D6301
SW6301
P6301
H
G
F
E
D
C
B
A
TN3

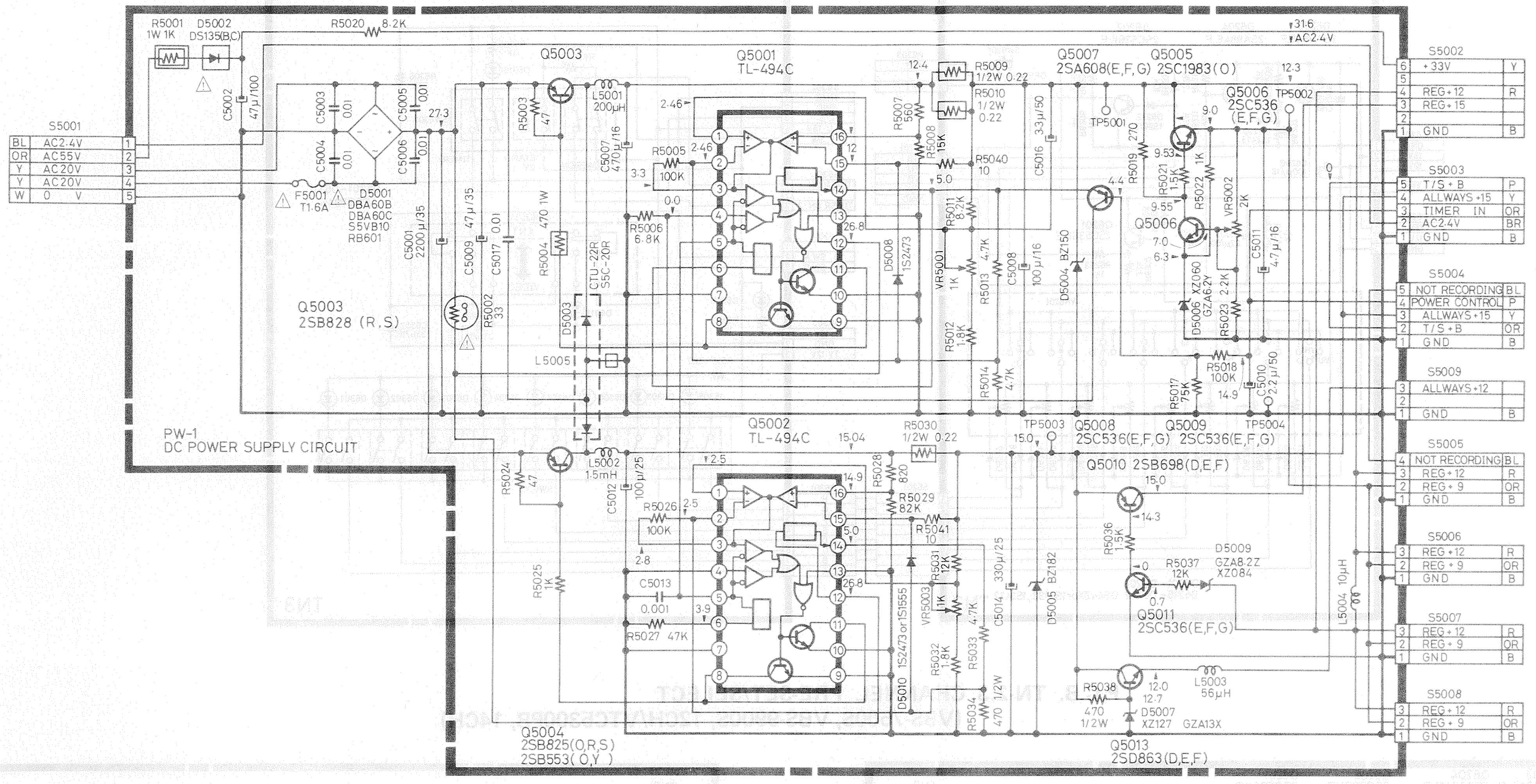
ELECT


TN 3
SW6302
POWER ON
STAND BY
TIMER
D6310
R6301 1K
R6303 1K
R6306 33K
S6302
TUME
GND
T/S
ALL 15V
PSW
D6308
D6307
D6306
D6305
D6304
D6303
D6302
D6301
S6304
TIMER ON1
TIMER ON2
S6303
12V
GND
TV 12V
R6307 560Ω
R6302 1K
D6309
P6301
H
G
F
E
D
C
B
A
SW6301
D6301 ~ D6310 PR5704S

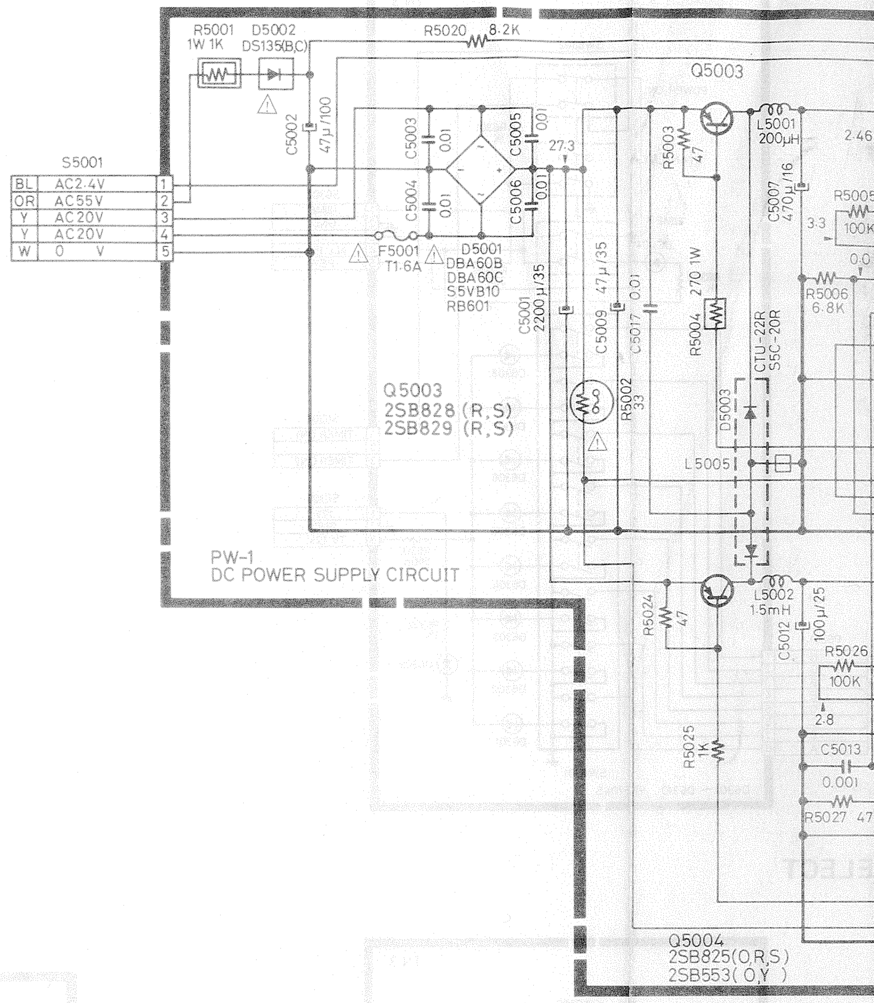
P.C.B. TN-2.3 CHANNEL PRE-SET/SELECT
(VBS-7500S, VBS-9900S, 12CH/VTC5300PB, 14CH)


Q6203 2SA984E,F
Q6204 2SA984E,F
Q6202 2SC536KE
Q6201 2SC536KE
TN2
S6204
E
15V
12V
33V
C6205 100μ/16
C6206 100μ/16
R6209 2.2K
R6208 2.2K
R6210 2.2K
R6207 15K
D6230
R6211 15K
R6206 10K
D6232 1S2473
R6204 100K
R6205 1M
R6202 39K
R6201 470K
C6204 0.01
C6203 22μ/50
D6229 μPC574J
R6203 18K
S6202
15V
12V
E
SW6201
OFF
ON
P6203
AFT
AFT
P6201
UB
TU
VB
SW
E
VR6201
VL
VH
U
D6201
D6215
D6202
D6216
D6203
D6217
D6204
D6218
D6205
D6219
D6206
D6220
D6207
D6221
D6208
D6222
D6209
D6223
D6210
D6224
D6211
D6225
D6212
D6226
D6213
D6227
D6214
D6228
D6201~D6214
D6215~D6228
DS442X or 1SS132, 1S2472
S6202
N
M
S6201
L
K
J
I
H
G
F
E
D
C
B
A
P6302
N
M
P6301
L
K
J
I
H
G
F
E
D
C
B
A
TN3
S6301
TUME
E
T/S
ALL 15V
PSW
S6303
TIMER ON1
TIMER ON2
S6302
12V
E
TV12V
SW6302
R6309 1K
D6315
R6310 560
R6308 1K
D6316
R6305 1K
R6306 33K
POWER ON
STAND BY
TIMER
D6301~ D6316 PR5704S
D6314
D6313
D6312
D6311
D6310
D6309
D6308
D6307
D6306
D6305
D6304
D6303
D6302
D6301
SW 6301

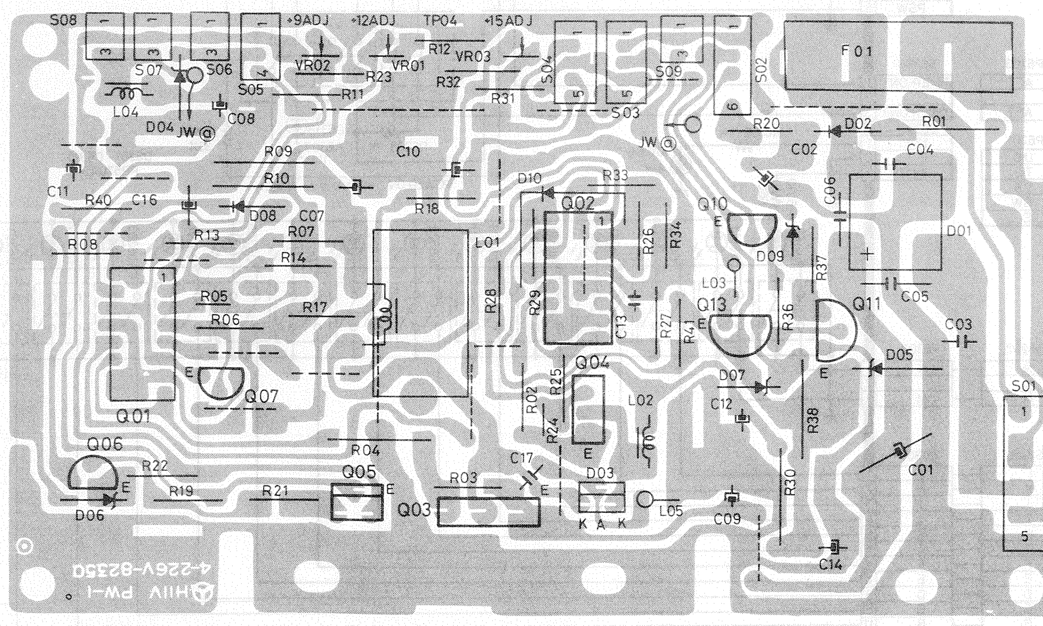
P.C.B. PW-1 DC SUPPLY CIRCUIT


S5001
BL AC2.4V
OR AC55V
Y AC20V
Y AC20V
W 0 V
R5001 1W 1K
D5002 DS135(B,C)
R5020 8.2K
F5001 T1.6A
D5001 DBA60B DBA60C S5VB10 RB601
C5001 2200μ/35
Q5003
Q5003 2SB828 (R,S)
L5001 200μH
L5005
Q5001 TL-494C
Q5002 TL-494C
Q5004 2SB825(O,R,S) 2SB553(O,Y)
Q5007 2SA608(E,F,G)
Q5005 2SC1983(O)
Q5006 2SC536 (E,F,G)
Q5008 2SC536(E,F,G)
Q5009 2SC536(E,F,G)
Q5010 2SB698(D,E,F)
Q5011 2SC536(E,F,G)
Q5013 2SD863(D,E,F)
L5002 1.5mH
L5003 56μH
L5004 10μH
TP5001
TP5002
TP5003
TP5004
PW-1 DC POWER SUPPLY CIRCUIT
S5002
6 +33V Y
5
4 REG+12 R
3 REG+15 B
2
1 GND B
S5003
5 T/S+B P
4 ALLWAYS+15 Y
3 TIMER IN OR
2 AC2.4V BR
1 GND B
S5004
5 NOT RECORDING BL
4 POWER CONTROL P
3 ALLWAYS+15 Y
2 T/S+B OR
1 GND B
S5009
3 ALLWAYS+12
2
1 GND B
S5005
4 NOT RECORDING BL
3 REG+12 R
2 REG+9 OR
1 GND B
S5006
3 REG+12 R
2 REG+9 OR
1 GND B
S5007
3 REG+12 R
2 REG+9 OR
1 GND B
S5008
3 REG+12 R
2 REG+9 OR
1 GND B

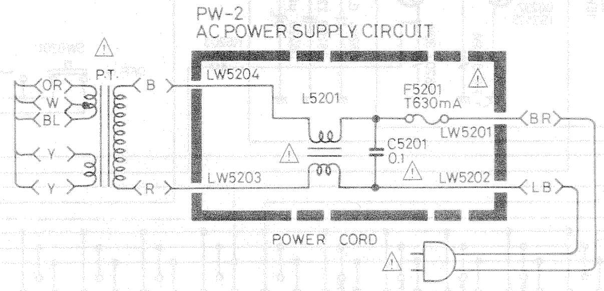
P.C.B. PW-1


S5001
R5001 1W 1K
D5002 DS135(B,C)
R5020 8.2K
Q5003 2SB828 (R,S) 2SB829 (R,S)
Q5004 2SB825(O,R,S) 2SB553(O,Y)
PW-1 DC POWER SUPPLY CIRCUIT

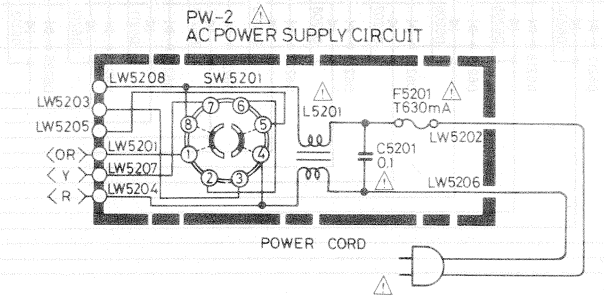
P.C.B. PW-1 DC SUPPLY


S08
+9ADJ
+12ADJ
TP04
+15ADJ
F01
S07
S06
S05
S04
S03
S09
S02
S01
Q01
Q02
Q03
Q04
Q05
Q06
Q07
Q10
Q11
Q13
D01
D02
D03
D04
D05
D06
D07
D08
D09
D10
L01
L02
L03
L04
L05
VR01
VR02
VR03
4-226V-B235Q
HIIV PW-1

P.C.B. PW-2 AC SUPPLY CIRCUIT


PW-2 AC POWER SUPPLY CIRCUIT
P.T.
LW5204
L5201
F5201 T630mA
LW5201
C5201 0.1
LW5203
LW5202
POWER CORD

P.C.B. PW-2 AC SUPPLY CIRCUIT (South Africa, Indonesia)


PW-2 AC POWER SUPPLY CIRCUIT
LW5208
SW5201
LW5203
LW5205
L5201
F5201 T630mA
LW5202
C5201 0.1
LW5201
LW5207
LW5204
LW5206
POWER CORD

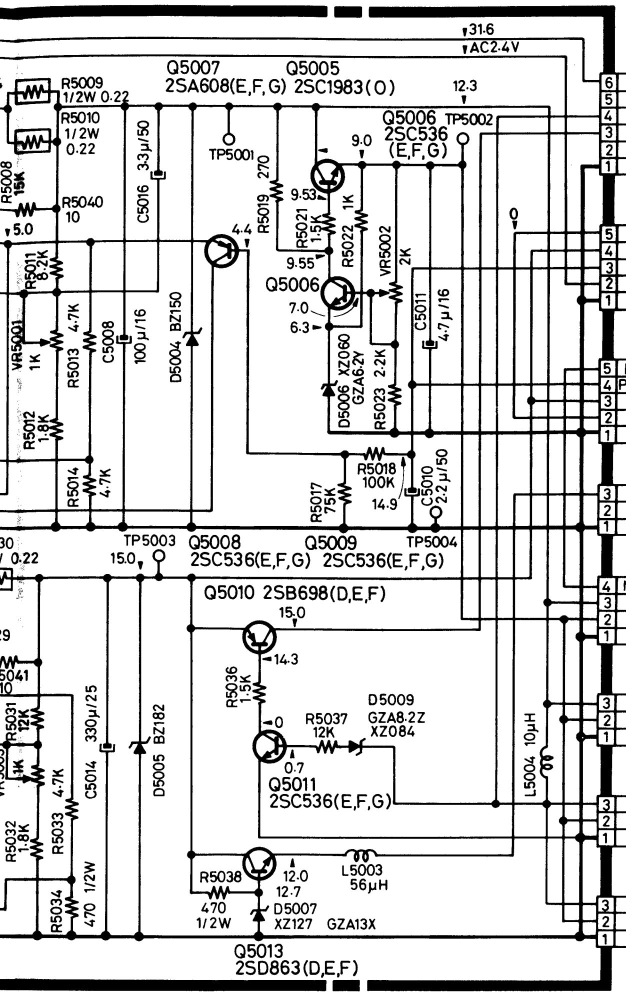
NOTES:

1. All resistance values in "OHMS" unless otherwise noted. (K=1,000 M=1,000,000)
2. All capacitance values in "μfd" unless otherwise noted.
   p = pico farad
3. All inductance values in "mH" unless otherwise noted. μ= micro henry
4. Marks indicated in each connector indicate the following color of wire.

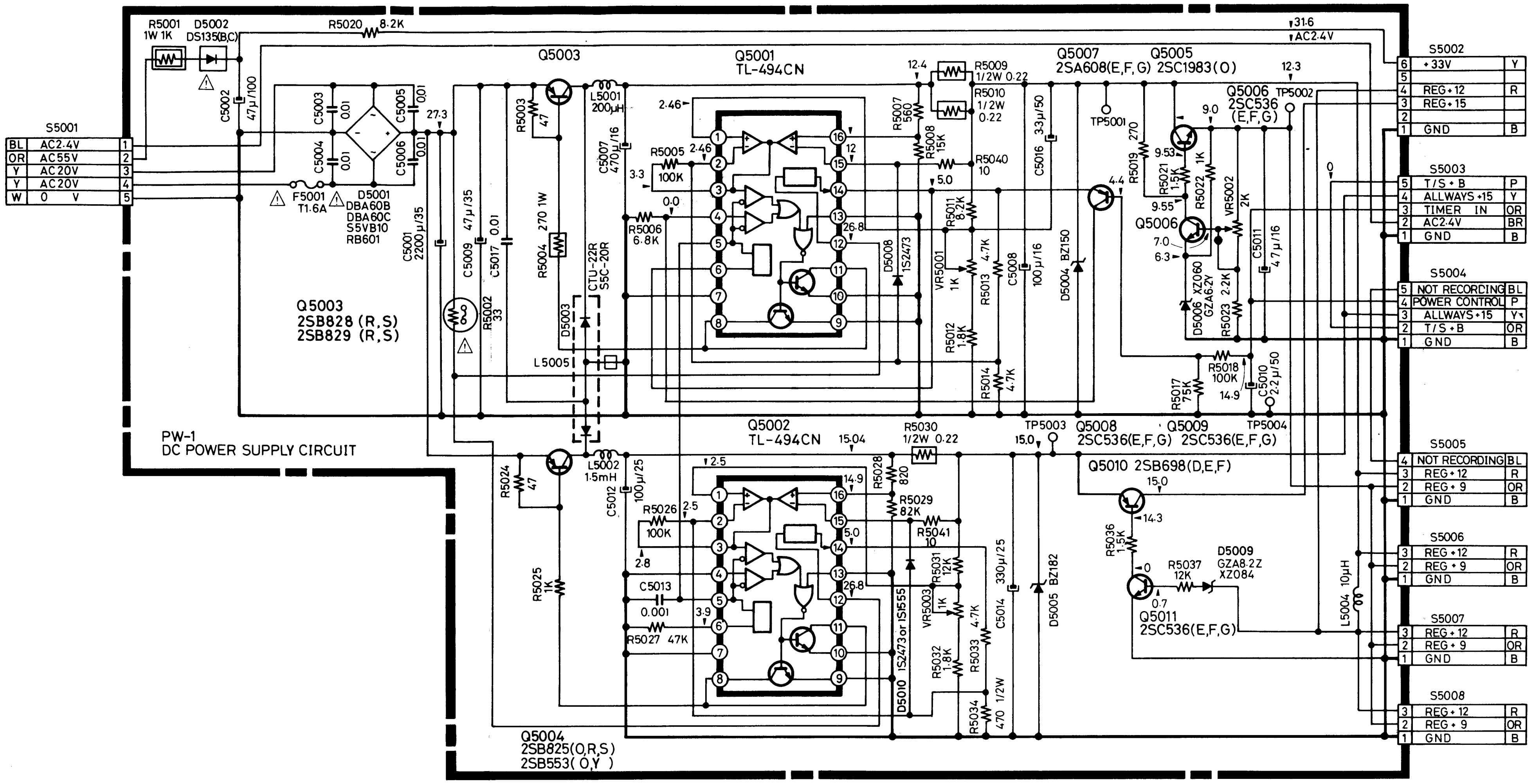
B : Black
R : Red
W : White
P : Pink

V : Violet
Y : Yellow
G : Gray
LB : Light Blue

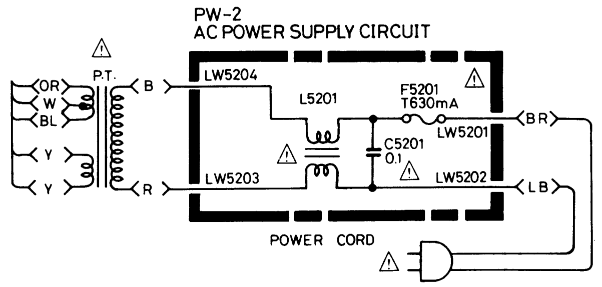
BR : Brown
GR : Green
BL : Blue
OR : Orange


R5009 1/2W 0.22
R5010 1/2W 0.22
Q5007 2SA608(E,F,G)
Q5005 2SC1983(O)
Q5006 2SC536 (E,F,G)
TP5001
TP5002
Q5006
D5004 BZ150
D5006 XZ060 GZA6.2Y
VR5002 2K
R5018 100K
C5010 22µ/50
S5002
S5003
S5004
S5009
S5005
S5006
S5007
S5008
TP5003
Q5008 2SC536(E,F,G)
Q5009 2SC536(E,F,G)
TP5004
Q5010 2SB698(D,E,F)
R5037 12K
D5009 GZA8.2Z XZ084
Q5011 2SC536(E,F,G)
D5005 BZ182
L5004 10µH
R5038 470 1/2W
D5007 XZ127 GZA13X
L5003 56µH
Q5013 2SD863(D,E,F)
+33V
REG+12
REG+15
GND
T/S+B
ALLWAYS+15
TIMER IN
AC2.4V
NOT RECORDING
POWER CONTROL
ALLWAYS+12
REG+9

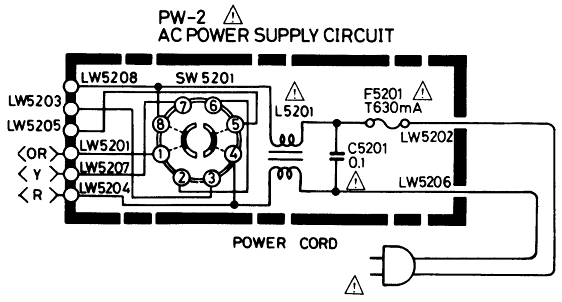
P.C.B. PW-1 DC SUPPLY CIRCUIT
(Australia, New Zeland, Indonesia)


R5001 1W 1K
D5002 DS135(B,C)
R5020 8.2K
S5001
AC2.4V
AC55V
AC20V
AC20V
0 V
F5001 T1.6A
D5001 DBA60B DBA60C S5VB10 RB601
C5001 2200µ/35
C5009 47µ/35
Q5003
Q5003 2SB828 (R,S) 2SB829 (R,S)
R5002 33
R5004 270 1W
CTU-22R S5C-20R
L5005
L5001 200µH
C5007 470µ/16
R5005 100K
R5006 6.8K
Q5001 TL-494CN
D5008 1S2473
R5007 560
R5008 15K
R5009 1/2W 0.22
R5010 1/2W 0.22
R5040 10
Q5007 2SA608(E,F,G)
Q5005 2SC1983(O)
Q5006 2SC536 (E,F,G)
TP5002
TP5001
VR5001 1K
D5004 BZ150
D5006 XZ060 GZA6.2Y
VR5002 2K
R5018 100K
C5010 22µ/50
PW-1 DC POWER SUPPLY CIRCUIT
Q5002 TL-494CN
R5030 1/2W 0.22
L5002 1.5mH
C5012 100µ/25
R5026 100K
R5028 820
R5029 82K
R5041 10
C5013 0.001
R5027 47K
VR5003 1K
D5010 1S2473 or 1S1555
TP5003
Q5008 2SC536(E,F,G)
Q5009 2SC536(E,F,G)
TP5004
Q5010 2SB698(D,E,F)
R5037 12K
D5009 GZA8.2Z XZ084
Q5011 2SC536(E,F,G)
D5005 BZ182
L5004 10µH
Q5004 2SB825(Q,R,S) 2SB553(O,Y)
S5002
S5003
S5004
S5005
S5006
S5007
S5008
+33V
REG+12
REG+15
GND
T/S+B
ALLWAYS+15
TIMER IN
AC2.4V
NOT RECORDING
POWER CONTROL
REG+9

P.C.B. PW-2 AC SUPPLY CIRCUIT


PW-2 AC POWER SUPPLY CIRCUIT
P.T.
LW5204
L5201
F5201 T630mA
LW5201
C5201 0.1
LW5203
LW5202
POWER CORD
OR
W
BL
Y
Y
B
R
BR
LB

P.C.B. PW-2 AC SUPPLY CIRCUIT
(South Africa, Indonesia)


PW-2 AC POWER SUPPLY CIRCUIT
LW5208
SW 5201
LW5203
LW5205
LW5201
LW5207
LW5204
L5201
F5201 T630mA
LW5202
C5201 0.1
LW5206
POWER CORD
OR
Y
R

NOTES:

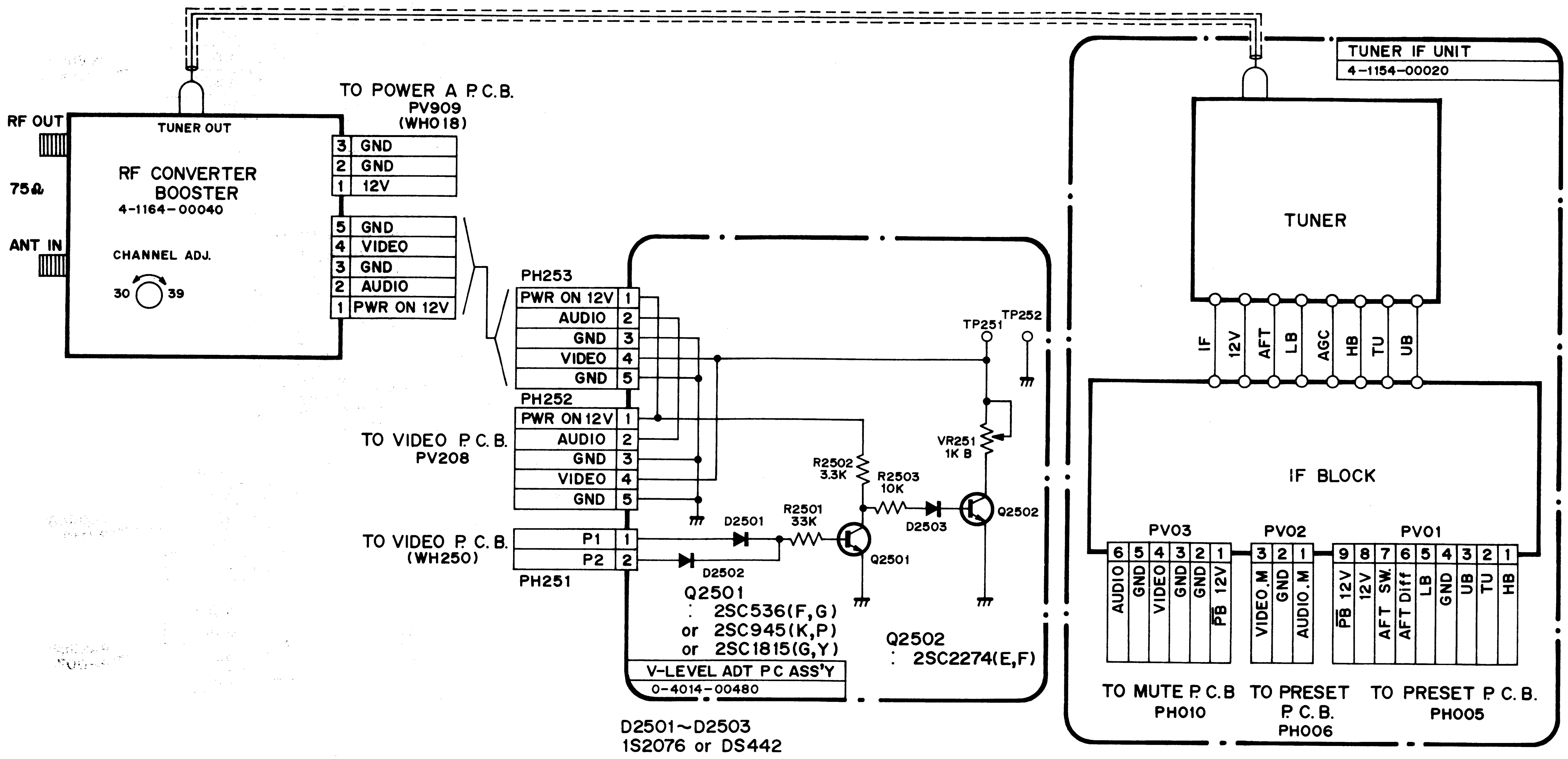
1. All resistance values in "OHMS" unless otherwise noted. (K=1,000 M=1,000,000)
2. All capacitance values in "µfd" unless otherwise noted. p = pico farad
3. All inductance values in "mH" unless otherwise noted. µ= micro henry
4. Marks indicated in each connector indicate the following color of wire.

B: Black	V : Violet	BR : Brown
R: Red	Y : Yellow	GR : Green
W: White	G : Gray	BL : Blue
P: Pink	LB : Light Blue	OR : Orange

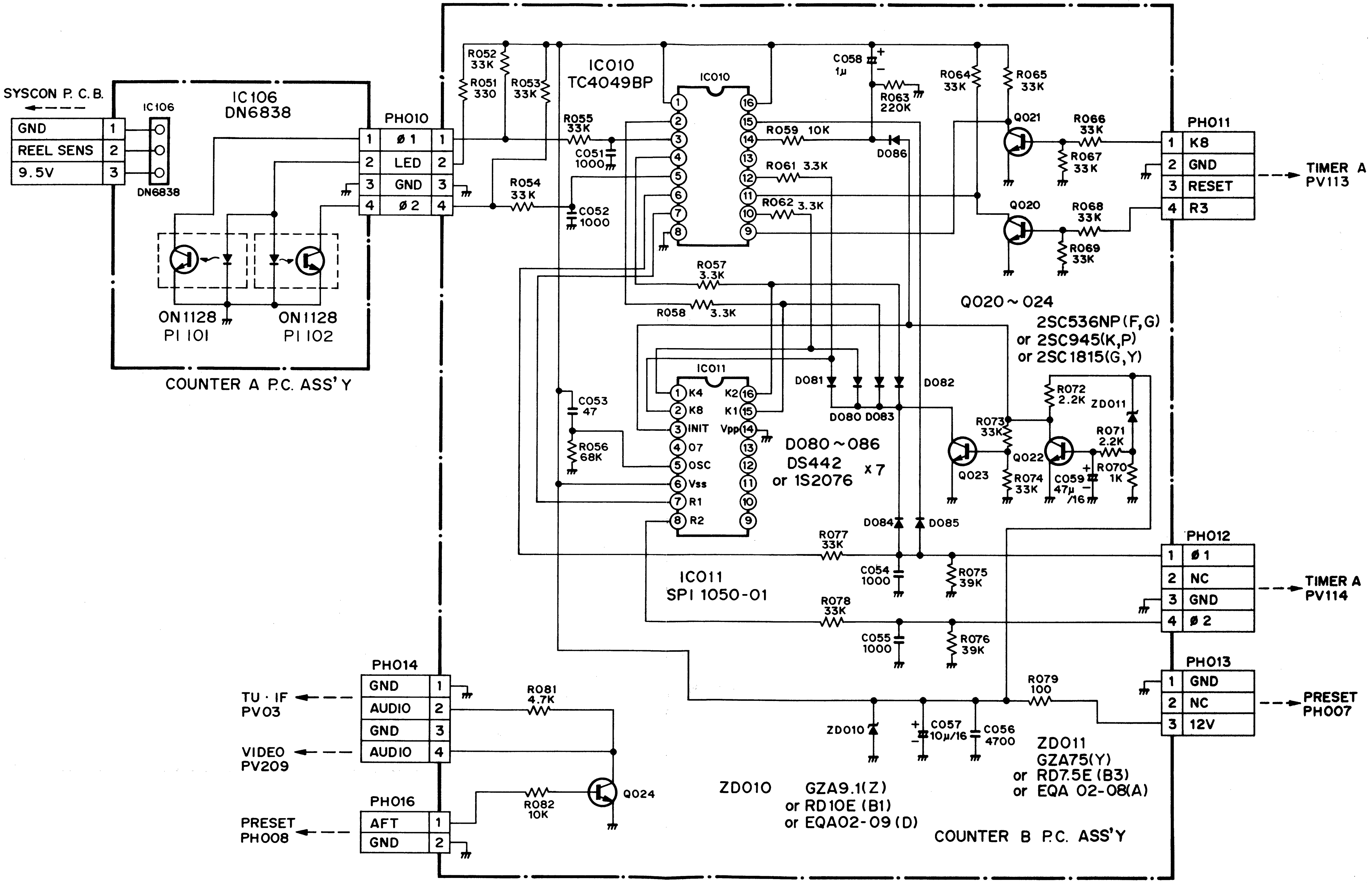
PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A UNIT. COMPONENTS INDICATED BY THE SYMBOL ⚠ IN THIS SCHEMATIC DIAGRAM SHOW COMPONENTS WHOSE VALUE HAVE SPECIAL SIGNIFICANCE TO PRODUCT SAFETY. IT IS PARTICULARLY RECOMENDED THAT ONLY PARTS SPECIFIED ON THE ATTACHED PARTS LIST BE USED FOR COMPONENT REPLACEMENT DESIGNATED BY THE SYMBOL.

TUNER RF CONVERTER DIAGRAM


RF OUT
75Ω
ANT IN
TUNER OUT
RF CONVERTER BOOSTER
4-1164-00040
CHANNEL ADJ.
30
39
TO POWER A P.C.B.
PV909
(WH018)
3 GND
2 GND
1 12V
5 GND
4 VIDEO
3 GND
2 AUDIO
1 PWR ON 12V
PH253
PWR ON 12V 1
AUDIO 2
GND 3
VIDEO 4
GND 5
PH252
PWR ON 12V 1
AUDIO 2
GND 3
VIDEO 4
GND 5
TO VIDEO P.C.B.
PV208
TO VIDEO P.C.B.
(WH250)
P1 1
P2 2
PH251
D2501
D2502
R2501
33K
Q2501
R2502
3.3K
R2503
10K
D2503
Q2502
VR251
1K B
TP251
TP252
Q2501
: 2SC536(F,G)
or 2SC945(K,P)
or 2SC1815(G,Y)
Q2502
: 2SC2274(E,F)
V-LEVEL ADT P.C ASS'Y
0-4014-00480
D2501~D2503
1S2076 or DS442
TUNER IF UNIT
4-1154-00020
TUNER
IF
12V
AFT
LB
AGC
HB
TU
UB
IF BLOCK
PV03
6 5 4 3 2 1
AUDIO
GND
VIDEO
GND
GND
P̄B̄ 12V
PV02
3 2 1
VIDEO.M
GND
AUDIO.M
PV01
9 8 7 6 5 4 3 2 1
P̄B̄ 12V
12V
AFT SW.
AFT Diff
LB
GND
UB
TU
HB
TO MUTE P.C.B
PH010
TO PRESET P.C.B.
PH006
TO PRESET P.C.B.
PH005

COUNTER DIAGRAM


SYSCON P. C. B.
GND 1
REEL SENS 2
9.5V 3
IC106
DN6838
IC106
DN6838
ON1128
PI 101
ON1128
PI 102
COUNTER A P.C. ASS'Y
PH010
1 ø1 1
2 LED 2
3 GND 3
4 ø2 4
R052 33K
R051 330
R053 33K
R055 33K
C051 1000
R054 33K
C052 1000
IC010
TC4049BP
IC010
C058 1μ
R063 220K
R059 10K
D086
R061 3.3K
R062 3.3K
R064 33K
R065 33K
Q021
R066 33K
R067 33K
Q020
R068 33K
R069 33K
PH011
1 K8
2 GND
3 RESET
4 R3
TIMER A
PV113
R057 3.3K
R058 3.3K
Q020 ~ 024
2SC536NP(F,G)
or 2SC945(K,P)
or 2SC1815(G,Y)
IC011
K4 K2
K8 K1
INIT Vpp
O7
OSC
Vss
R1
R2
C053 47
R056 68K
D081
D080 D083
D082
D080 ~ 086
DS442
or 1S2076
x 7
R072 2.2K
ZD011
R073 33K
R071 2.2K
Q022
Q023
R074 33K
C059 47μ /16
R070 1K
D084
D085
R077 33K
C054 1000
R075 39K
PH012
1 ø1
2 NC
3 GND
4 ø2
TIMER A
PV114
IC011
SPI 1050-01
R078 33K
C055 1000
R076 39K
PH013
1 GND
2 NC
3 12V
PRESET
PH007
R079 100
ZD010
C057 10μ/16
C056 4700
ZD011
GZA75(Y)
or RD7.5E(B3)
or EQA 02-08(A)
PH014
GND 1
AUDIO 2
GND 3
AUDIO 4
TU · IF
PV03
VIDEO
PV209
R081 4.7K
Q024
R082 10K
PH016
AFT 1
GND 2
PRESET
PH008
ZD010 GZA9.1(Z)
or RD10E(B1)
or EQA02-09(D)
COUNTER B P.C. ASS'Y